Accounting and Business Research

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Constructing a Total Cost of Ownership supplier selection methodology based on Activity-Based Costing and mathematical programming

Z. Degraeve, Eva Labro and F. Roodhooft*

Abstract—In this paper we elaborate on a Total Cost of Ownership (TCO) supplier selection methodology that we have constructed using real life case studies of three different industrial components groups in a firm. These case studies are presented in this article. Analysing the value chain of the firm, data on the costs generated by the purchasing policy and on supplier performance are collected using Activity-Based Costing (ABC). Since a spreadsheet cannot encompass all these costs, let alone optimise the supplier selection and inventory management policy, a mathematical programming model is used. For a specific component group the combination of suppliers is selected that minimises the TCO. TCO takes into account all costs that the purchase and the subsequent use of a component entail in the entire value chain of the company. The TCO approach goes beyond minimising purchase price and studies all costs that occur during the entire life cycle of the item in the organisation. Possible savings of between 6% and 14% of the total cost of ownership of the current purchasing policy are obtained for the three cases. ABC is not an optimisation tool as such, but provides important accurate input to the optimising mathematical program, whereas the Operations Research literature usually only distinguishes between variable and fixed costs. We show that the integration of both delivers better results in the setting we have studied.

1. Introduction

Purchasing determines an important part of the competitive position of most firms. It accounts for 60% to 70% of total expenditures in manufacturing (Herberling, 1993), leads to long term relationships and influences the activities in the complete value chain of the firm. However, in both the operations management and operations research literature much more effort has been put into obtaining cost reductions in further stages of the value chain, especially in increasing production efficiency. Although purchasing probably does not receive the attention it deserves in Western academic literature, it is a field where large cost reductions can be obtained, as is shown by the Japanese who have traditionally paid more attention to this field. The cases reported on here, however, are in a traditional Western firm. The management accounting literature has recently picked up this inter-firm setting as an interesting area to study. Seal et al. (1997) present evidence on the role of accounting in developing a strategic supply partnership in an action research study. Ittner et al. (1999) look at the effect supplier selection has on company performance and the intervening variables in this relationship. Cooper and Slagmulder (1999) present a book with case studies of cost management in the supply chain. Van der Meer-Kooistra and Vosselman (2000) discuss management control issues in inter-firm relationships. Baiman and Rajan (2002) provide an overview of the incentive issues in inter-firm relationships identified by both the complete and the incomplete contracting literature. Dekker (2003) looks at the provision of information to co-ordinate and optimise the supply chain in a case study.

Within the purchasing framework, decisions that have to be taken include supplier selection and determination of order quantities to be placed with these selected suppliers through time. Supplier selection decisions have a multiple objective character. At least 23 criteria for this selection problem have been identified in the literature (Dickson, 1966; Weber et al., 1991). These include among others: net price, quality, delivery, supplier performance history, capacity, communication systems, service and geographical location. The problem is how to select suppliers that perform

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satisfactorily on the desired dimensions.

Published vendor selection models formulate answers to this multiple objective problem. Some authors propose linear weighting models in which suppliers are rated on several criteria and in which these ratings are combined into a single score (e.g. Gregory, 1986; Nydick and Hill, 1992; Willis et al., 1993). These rating models are very subjective and often sensitive to different rating scales, weights and/or ratings by different people. Total cost approaches (e.g. Monckza and Trecha, 1988; Smytka and Clemens, 1993) attempt to quantify all costs related to the selection of a vendor in monetary units but often fail to include the more qualitative criteria. Mathematical programming models (e.g. Chaudhry et al., 1993; Current and Weber, 1994; Sadrian and Yoon, 1994) often consider only the more quantitative criteria.

In this paper, we combine a total cost approach with mathematical programming because the dimensions of the problem cannot be handled using a simple spreadsheet. We propose a Management Information System (MIS) that simultaneously treats the supplier selection and the inventory management decision for multiple components over several time periods in a mathematical programming model. This MIS is based on Total Cost of Ownership (TCO) and Activity-based Costing (ABC) information (Degraeve and Roodhooft, 2000) and programmed in LINGO (Schrage, 1998). For a specific component group the combination of suppliers is selected that minimises the Total Cost of Ownership. TCO takes into account all costs that the purchase and the subsequent use of a component entail in the entire value chain of the company (Shank and Govindarajan, 1992). The TCO approach goes beyond minimising purchase price and studies all costs that occur during the entire life cycle of the item in the organisation. These include among others costs related to service, quality, delivery, administration, inventory holding, communication and defects. ABC makes the quantification of the cost criteria possible. ABC is not an optimisation tool as such, but provides important accurate input to the optimising mathematical program, whereas the Operations Research literature usually only distinguishes between variable and fixed costs. One of the contributions of our paper is to go beyond the traditional single methodological approach to cost management. We do not just look at potential benefits with ABC or alternatively just at the benefits of using optimisation techniques. Instead we combine the two approaches and consider the joint benefits from applying both techniques simultaneously. We show that the integration of both delivers better results in the setting we have studied.

Several authors have identified TCO analysis as a way to improve purchasing (e.g. Ellram 1995a, Smytka and Clemens, 1993). Ellram (1995b) writes about the link between TCO and ABC, but in our opinion has a fairly limited view on ABC. She asserts that, in purchasing, ABC focuses on the internal administrative costs of the purchasing department and assigns costs to the product, customer or distribution channel. In our opinion, however, ABC can also be used to study costs in other departments that can be influenced by the purchasing policy and 'the supplier selection policy' can be used as a cost object instead of the more traditional cost objects mentioned by Ellram.

Mathematical programming (MP) techniques have been applied to purchasing issues frequently, mainly in the domain of determining order quantities, specifically in environments where complex discounts are offered by suppliers (e.g. Benton, 1991; Benton and Park, 1996; Chaudhry et al., 1993; Sadrian and Yoon, 1994; Rosenthal et al., 1995), but also in supplier selection (e.g. Akinc, 1993; Current and Weber, 1994).

Shapiro (1999) argues that mathematical programming models can serve as a template for cost and resource data to be extracted by ABC methods. Our use of MP is classified in what he calls a type 4 model where the objective is to minimise cost over supply chain resources in a multiple period, deterministic environment. To our knowledge, Degraeve and Roodhooft (2000) were the first to make the link between TCO, ABC and mathematical programming for supplier selection. They illustrate this link on an imaginary case. Degraeve and Roodhooft (1999, 1998 respectively) illustrate the use of this method on rather small case studies of buying heating electrodes and ball bearings respectively, at Cockerill Sambre, a Belgian firm in the steel industry.

1.1. Contribution of the paper

The incremental contribution of this paper is threefold. First, this is the first time that the management accounting aspect of the methodology is elaborated on and worked out extensively. Previous papers do not describe the value chain and ABC analysis linked to the specificity of the different product groups, nor do these papers discuss how the data are collected and what the problems related to this aspect are. We show how the mathematical programming model serves to define and structure the decision problem at hand. We obtain good results compared to the current purchasing policy because of our thorough data collection and ABC analysis within this structure.

Second, this paper situates the work specifically within the context of the constructive case study research methodology in management accounting (Kasanen et al., 1993), thereby indeed focusing more on the process aspects of the case study. It builds on the previous papers and proves that the

Table 1
Dimensions of the case studies

	Total number of different component types	*Number of different component types needed in 1999*	*Number of suppliers*	*Current monetary purchasing price ( )*
Resistors	1729	660	25	1,225,000
Transformers	543	260	39	8,044,000
PCBs	336	132	24	5,263,000

financial results of the previous cases can be transferred to other component groups in another firm thereby generalizing previous results.

Third, the model in this paper is more complex than those in the previous papers on several dimensions. Because of the extended value chain and ABC analysis, the number of criteria and different costs considered are substantially larger. Also the monetary amounts involved are larger (€16,011,000 vs. €200,000 (Degraeve and Roodhooft, 1999) and €1,303,000 (Degraeve and Roodhooft, 1998)). The complexity increase is also indicated by the size of the component groups (1,052 different component types vs. one and 33 respectively) and the supplier base from which to select (88 suppliers vs. three and six respectively). This results in a substantially increased number of variables and constraints in the mathematical programming model. Also, the overlap between the suppliers and component types is substantial, preventing us from using a decomposition method to solve the problem.

1.2. Cases at the case firm

Using our theoretical ABC framework for supplier selection, we developed a MIS for a division in Europe of a worldwide telecommunications firm that is one of the leaders in the high speed access and transmission market. The firm has 116,000 employees worldwide and is represented in 130 countries. Global sales amount to €23 bn. The division studied offers a complete portfolio of the worldwide firm from micro-electronics and telecommunications to cables and components and employs 4,600 people in the country of its location. The purchasing department's mission statement includes 'cost of ownership' as an expectation of their (internal) customers:

> 'To explore the market and to purchase and deliver [...] conform to the requirements, with a maximum of flexibility and reliability, with a competitive "Cost of Ownership", continuously.' (emphasis in original)

To achieve this goal the firm uses a vendor rating system that takes price, technology, quality, flexibility and delivery reliability into account. An effort is made to buy as much as possible from suppliers with a preferred status. An Economic Order Quantity (EOQ) model calculates the order points, but does not link this decision to the supplier selection decision.

The MIS is developed for three major bought-in product groups: resistors, transformers and printed circuit boards (PCB). These component groups are selected because the relevant criteria and costs differ substantially between them. In this way, the external validity of the study is increased by constructing a toolbox that is widely applicable to similar decision problems in different business contexts. We assume that the component groups are independent from each other and study them separately. Although an occasional supplier delivers items in more than one of the component groups, these links are negligible and the total dimensions of the cases prevent us from looking at the three component groups at the same time. Together, the three component groups account for about €14m in total costs. The dimensions of the cases studied are vast and involve a considerable amount of money, as shown in Table 1. The first column gives the number of different types of components used in the firm. The second column states for how many of these types there was a demand in 1999, the year of study. The third column indicates the number of possible suppliers. The fourth column gives the current monetary purchasing price in euro.

Prices for different types of electrical components may vary substantially. The 1,729 resistor types are classified in two basic types, thickfilm chips and minimelfs with thin film technology. Minimelfs have a lower temperature coefficient, better current-noise characteristics and a better stability with respect to overheating, but are more expensive. Prices quoted for transformers are a function of their core type, the number of windings, the quantity ordered and insulation requirements. The production cost of the Printed Circuit Board (PCB) suppliers depends, among others, on type of material, number of layers, drill size, finishes, density, thickness and board area. Asian PCB suppliers are cheaper but have a longer lead time, provide less service and do not have special technologies available.

The remainder of the paper elaborates on the supplier selection methodology developed. Section 2 explores the activities performed in the value chain of the purchasing firm. Section 3 explains how Activity-based Costing data were gathered to cost out these activities and which types of information are collected about the performance of the suppliers on the different supplier selection criteria that generate costs in the value chain of the firm. Section 4 shows how the data are translated into the objective function and constraints of the mathematical programming models. The next section interprets the results and discusses strategic insights for the purchasing policy. The last section concludes.

2. The value chain and activities

We study the activities in the value chain of the firm that relate to the purchasing policy in the first step of the vendor selection methodology. These can either be activities of the purchasing department itself or activities further down the value chain that are influenced by policy decisions made by the purchasing department. Figure 1 shows the activities, where they are situated in the value chain and how they relate back to the purchasing policy in the case study firm. It is important to perform this value chain analysis, as these activities and their costs will later be modelled in the mathematical programming model. The rest of this section describes the activities in the value chain of the firm.

The purchasing engineer responsible for a component group negotiates with the suppliers on among others price, discounts, quality, lead time and follows up the relationship to sustain the supplier in the supply base. When the supplier is new to the firm or when quality problems arise too frequently, the quality team sometimes performs a quality audit on the supplier's site.

Ordering can start once the relationship with the supplier is set up and the supplier is selected for a certain component type. Depending on the supplier/component combination orders can be placed through electronic data interchange (EDI) via a private network, automatic call-off (ACO) on a frame agreement or the manuals by sending a fax.[1] The first time an order is placed for a specific PCB with a supplier, a tooling cost might be charged by the supplier to cover the supplier's one/off costs on films, drilling information and electrical testing. Suppliers with a shorter lead-time are more flexible in that they can accommodate a sudden change in demand on a shorter notice period and thus agree a delivery date that is nearer in time than other suppliers can.[2] A supplier's delivery reliability depends on the history of early and late deliveries around the agreed delivery date. Importing documents have to be filled out and import duty has to be paid when the component is ordered with a supplier outside the EC.

Defects can be discovered at three points in the value chain: in receiving, in production or by the customer. The receiving department receives the delivery and inspects it together with the inspecting department.[3] When no irregularities are discovered during the inspection, the supplier accounting for the delivery is done and the invoice is paid. For transformers and PCBs some suppliers offer component specific discounts on prices for larger orders and this discount may rise with the quantity ordered. Some transformers and PCB suppliers add a lot charge to the invoice. Payment delays typically range from cash payment to 60 days delay, with 0 to 3% payment discounts. However, when a defect is discovered in inspection, components are either sent back to the vendor who will send a credit note or will replace them at his expense, or they are thrown away at the firm's own expense. When the supplier replaces the components, they go through the whole cycle of importing, receiving and inspecting again. After a satisfactory inspection the components are transported to the warehouse where they are held in inventory until the production planning triggers a demand for the component on the production floor. The components are used to manufacture more complex electronic components or end-user products that are sold by the marketing department.

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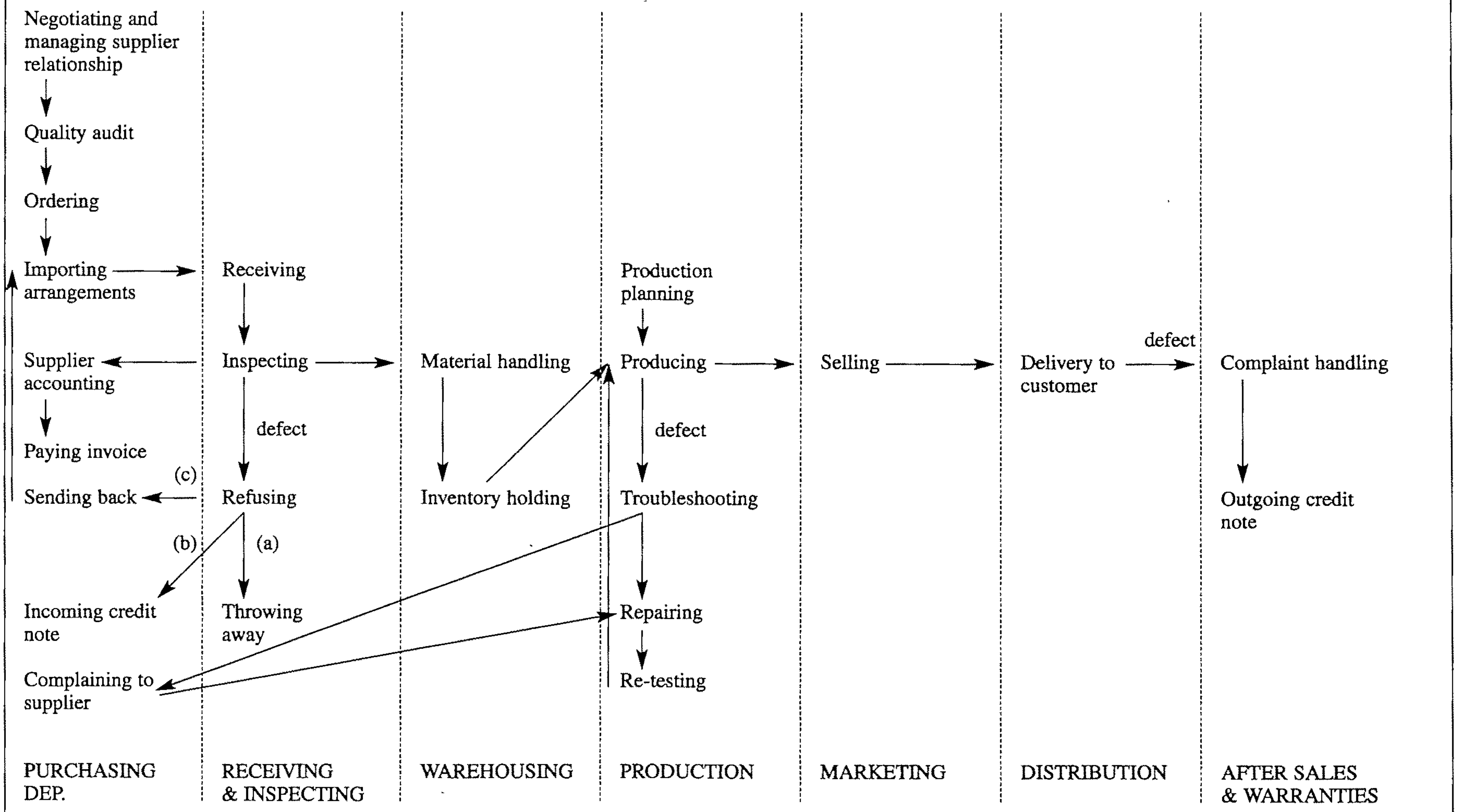
[1] The minimum order quantity and the lot size have to be adhered to when ordering. Orders for a component thus have to exceed the minimum order quantity for that component with that supplier and be a multiple of the lot size. As a rule, the lot size is always lower than or equal to the minimum order quantity.

[2] Asian suppliers generally have a longer lead-time than European and American suppliers.

[3] Different sorts of inspections are used, depending on the inspection class in which the supplier/component combination is allocated and resulting in more or less time-consuming inspection activities. For purchases with certified suppliers, the receiving department may release the components without any quality verification. The trust in these suppliers' quality systems makes extra inspection superfluous, as the details on the specifications, the level of quality, the criteria for acceptation of the delivery, the supplier's auditable quality plan and the markings on the packaging are agreed on in writing in the quality agreement. Other components are inspected visually. A skip lot inspection may be performed for components that are delivered frequently. In this case the first five deliveries and afterwards every fifth batch are each checked taking a sample, whereas the other four are only checked visually. In a few exceptional cases, the reception department releases transformers and PCBs delivered by uncertified suppliers without further inspection because their impact on business processes is considered small. For the odd resistor delivery, only the labels on the packaging are compared with the ones on the travel documents without opening the packaging. Occasionally, every PCB lot is checked using a sample from each lot. Some special PCBs are sent for verification to the engineer that ordered the component.

Figure 1
The value chain and activities influenced by the purchasing policy



However, some defective components that have slipped through incoming inspection turn up during production. This causes much extra work to troubleshoot the problem, complain to the supplier, repair and re-test the component. For PCBs the cost of discovering a problem in this phase in the value chain is the highest because usually the entire expensive PCB has to be thrown away, and other components already fixed on it cannot easily be salvaged. Sold products are delivered to the customer who, upon discovering a defect in this final phase of the value chain, files a complaint that results in the after sales department investigating the problem and writing an outgoing credit note.[4]

3. Data collection

3.1. Implementation issues

The developments in ABC, and the integration of these costing systems with company-wide information systems, could enable us to collect all necessary data on activities and supplier performance. However, in the case study firm, three data collection problems had to be overcome.

First, cost accountants in the firm put effort into defining activities, several non-unit cost drivers such as throughput time and orders are used, and the company's head of cost accounting gives presentations about ABC and how it is applied in the company. The cost accounting system is mainly used for variance analysis between the budgeted and the actual figures as well as for calculation of the tariff for services that are provided internally, such as information technology, training, and accounting. The company clearly expresses the wish to be on the forefront of developments in this area by applying ABC.

However, ABC was not fully integrated within the costing system and hence the basic features of the accounting system were predominantly of the standard costing type, although a high level of detail is visible. The firm defines about 1,500 different resource categories and 400 cost pools that are related to geographical locations, departments or products. Strangely, purchasing department overhead and the cost pool related to reception and inspection are allocated using a normal distribution over groups of suppliers, rated excellent, mediocre and bad on a combination of indices on delivery, quality and flexibility, as a percentage of the purchasing volume with these suppliers. Thus it is assumed that there will always be a specific percentage of each category of suppliers and that purchasing volume is the overall cost driver. Therefore, especially for this purchasing application of ABC, the company required considerable assistance from the authors.[5]

Second, the company has several databases that are not always integrated. The first is the accounting database, discussed in the previous paragraph. The second is the Purchasing Management System (PMS), which contains data on all component types and suppliers. Next, the Material Requirements Planning (MRP) provides forecasted demand figures. An economic order quantity (EOQ) calculation system that is directly fed by the MRP was put in place five years ago. The cost updated figures are, however, not automatically plugged into this EOQ model and have not been changed in five years. When the accountant participating in this study was made aware of this during the process of the development of the vendor selection model, he undertook the necessary steps to update the cost figures in the existing EOQ model. Besides these four systems, some purchasing engineers make use of their own spreadsheets. On some occasions, we discovered that the data in these spreadsheets did not correspond to the data in the overall PMS system. Overall, we found that there was hardly any integration between the different data sources.

Third, there was a major turnover of personnel involved in the study. Several people left for other firms, including the original champion of our study in the company. Other personnel took up completely different functions within the same company.

The process of collecting the data on costs and supplier performance and refining the costing system to reflect ABC principles was consequently time consuming as we had to consult several databases, always via a variety of company personnel, in order to set up our own ABC system and sort out discrepancies between data in the different files along the way. The most problematic discrepancy concerned the vendor lead time data, where purchasing managers' own spreadsheets were much more up to date than the EOQ system and mostly showed shorter possible vendor lead times. The next subsection describes how we proceeded with these difficult tasks.

3.2. Activity-based value chain analysis

First, the resources available to perform all the activities discussed in the previous section are examined. An example is the gross wage of the inspectors. Resource drivers establish a relationship between these resources and the activities. We checked, for example, how much time the inspectors spend on a skip lot inspection or on a full inspection. Personnel in the firm were asked to participate in several time estimate studies. Some resources are linked directly to the activity and need not be assigned through a resource driver. For example, the yearly EDI service fee is exclusively related to the EDI ordering activity. Columns 1, 2 and 3 of Table 2 indicate the direct or indirect link between resources and activities, and shows which resource drivers are used in the latter case.

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[4] The external customers of this firm assess only 1.7% of all defects, while the other complaints come from internal customers in the production department. The analysis of these external customer complaints over the year studied shows that none of them relate back to problems with the original component bought. Instead, they are due to faults in the production process or wrong deliveries.

[5] This is a typical feature of the constructive research approach as a scientific method.

Once the cost of performing an activity is calculated, activity drivers that determine the total cost of the purchasing policy are searched, using a cost hierarchy with several activity levels: supplier-, component-, order-, batch- and unit-level. The first hierarchical level describes costs incurred and conditions imposed whenever the purchasing company actually uses the supplier over the decision horizon. Costs on the supplier level include a quality audit cost incurred by the buyer for the evaluation of a supplier and the cost of a dedicated purchasing manager. This purchasing manager is responsible for both setting up the relationship with the supplier (e.g. writing up an overall quality agreement) and following up the relationship. The component level indicates costs incurred whenever the firm needs to buy this component. Tooling costs for the PCBs are incurred on this level as they are only charged the first time that the component is ordered with the supplier. Tooling costs vary with the supplier/PCB combination and might even be non-existent for some combinations. The order level parameters indicate costs incurred and conditions imposed each time an order is placed with a particular supplier and include, among others, costs associated with ordering and invoicing. At batch level, the firm incurs costs each time a batch is delivered, e.g. costs for reception, inspection, material handling, internal failure (components fail during production) and late delivery of the batch. At the unit level, we find costs incurred and conditions imposed related to the units of the components for which the procurement decision has to be made, for example, price, external failure (a component fails when used by the customer) and inventory holding due to early delivery. The three cases studied illustrate that the ABC hierarchy is case dependent, as is suggested in the literature (Ittner et al., 1997). For the resistor case, a hierarchy with only three levels, i.e. supplier, batch and unit, is used. Since an order for transformers or PCBs can include more than one type of component and the bought-in products are delivered per batch of the same component, we add an order level in these cases.

We include a component level in the hierarchy for the PCB case, as for some suppliers tooling costs are incurred the first time a specific PCB is ordered to cover their costs on films, drilling information and electrical testing. Table 3 shows how the hierarchy differs from case to case and on what levels the costs are incurred.

It is important to make this classification of activities into separate levels since the overall process driver for each level of activity, (1) number of suppliers, (2) number of components, (3) number of orders, (4) number of batches and (5) number of units procured, is assumed independent of the activities in other hierarchical levels. Column 4 of Table 2 shows the more detailed cost pools at which level the information was gathered. From the variables in the mathematical programming model, the level of variability of these details becomes clear: per supplier (e.g. import duty dependent on location of supplier insider or outside the EC), per supplier-component combination (e.g. for some components an automatic order through the automatic call off system is possible, while the same supplier may only accept a fax order for other components) or only dependent on the purchasing firm (e.g. material handling).

In this way, all costs caused by the selection of suppliers and the placement of orders with them can be determined. The final column of Table 2 shows the process drivers that drive the usage of activities by the supplier selection policy. These process drivers determine the level in the ABC hierarchy where the costs are incurred and will become the decision variables in the mathematical programming models.

In the next step, information is gathered on supplier performance at the detailed level of the cost pools and also data on prices, quantity discounts, supplier's lead time, tooling costs, minimum order quantity, lot size as well as probabilities of detecting default in inspection, production or by the external customer, are collected.

3.3. Methodological concerns

Before we proceed, an important caveat is in order. Applying Activity-based Costing assumes that the costs are linear (or step-linear) with the cost drivers. Research (e.g. Noreen, 1991; Bromwich, 1997; Maher and Marais, 1998), however, has shown that the conditions under which ABC provides accurate costs are rather stringent and in some cases hard to meet, especially when resources are provided on a joint and indivisible basis. Noreen and Soderstrom (1994) empirically test this linearity assumption for different categories of overheads and conclude that it is often not met. Datar and Gupta (1994) look at other possible errors in costing systems in general (not just ABC) and show that there exists a trade-off between reducing specification and aggregation error (which is often used as a justification for implementation of ABC systems) and increasing measurement error. We do acknowledge all these

Table 2
The ABC details for the supplier selection cases

Resources	*Resource drivers*	*Activities*	*Detailed activity cost pools*	*Activity driver as decision variable in mathematical programming model*	
Gross wages of purchasing manager	% of time spent	Negotiating and managing relationship	Hours negotiating and managing	# suppliers	
Gross wages of auditor + quality engineer	% of time spent	Quality audit	0/1 quality audit	# suppliers	
Gross wages of secretaries, buyers and purchasing engineers	% of time spent on EDI orders % of time spent on ACO orders % of time spent on manual orders	Ordering	EDI orders ACO orders	# orders	PURCHASING POLICY
Yearly EDI service fee + gateway fee	Direct with EDI ordering		Manual orders		
Computer used for EDI	Direct EDI ordering				
Fax machine	Direct with manual ordering				
Gross wages of secretaries, buyers and purchasing engineers	% of time spent on invoices	Invoicing		# orders	
Import duty	Direct with importing	Importing	Batches from outside EU	# batches	
Gross wages of secretaries	% of time spent on import declarations				
Gross wages of accountant	% of time spent	Supplier accounting		# batches	
Gross wages of receiving personnel	% of time spent	Receiving		# batches	
Gross wages of inspecting personnel	% of time spent on immediate releases % of time spent on visual inspections % of time spent on comparisons of labels on packaging % of time spent on skip lot inspections % of time spent on engineer verifications % of time spent on sample inspections of every lot	Inspecting	Immediate releases Visual inspections Comparisons of labels on packaging Skip lot inspections Engineer verifications Sample inspections of every lot	# batches	

Table 2
The ABC details for the supplier selection cases (continued)

Resources	*Resource drivers*	*Activities*	*Detailed activity cost pools*	*Activity driver as decision variable in mathematical programming model*
Inspecting equipment	Direct with inspecting			
Gross wages of inspecting personnel	% of time spent on refusing incoming orders or batches	Refusing a delivery		# batches
Gross wages of receiving personnel	% of time spent on refusing incoming orders or batches			
Gross wages of purchasing personnel	% of time spent on refusing incoming orders or batches			
Price	Direct with throwing away	Throwing away		# batches
Gross wages of secretaries	% of time spent on sending back and administration	Sending back	Sending back to EU supplier	# batches
Gross wages of accountant	% of time spent on accounting for sending back			
Postage	Direct with sending back		Sending back to outside EU supplier	
Export duty to outside EU suppliers	Direct with sending back outside EU			
Gross wages of accountant	% of time spent on incoming credit notes	Incoming credit note		# batches
Gross wages of warehousing personnel	% of time spent on transporting orders or batches to warehouse and shelving	Material handling		# batches
Gross wages of production personnel	% of time spent on troubleshooting after discovery of defect component	Troubleshooting		# batches
	% of time spent on repairing after discovery of defect component	Repairing		# batches
Repairing equipment	Direct with repairing			

Table 2
The ABC details for the supplier selection cases (continued)

Resources	*Resource drivers*	*Activities*	*Detailed activity cost pools*	*Activity driver as decision variable in mathematical programming model*	
Gross wages of production personnel	% of time spent on re-testing after discovery of defect component	Re-testing		# batches	
Testing equipment	Direct				
Gross wages of warehousing personnel	% of time spent on maintaining inventory	Inventory holding		# units of component	PURCHASING POLICY
Heating costs	m^2				
Warehouse maintenance	m^2				
Fire insurance	m^2				
Opportunity cost	Interest % to be gained on risk free investment				
Obsolescence cost	% of unit price				
Gross wages of personnel in complaint handling department	% of time spent on complaint handling	Complaint handling		# units of component	
Gross wages of personnel in complaint handling department	% of time spent on making up outgoing credit note	Outgoing credit note		# units of component	

# : number of

Table 3
Activity-based costs and hierarchy for the three case studies

	Resistors	*Transformers*	*Printed circuit boards*
Supplier level costs	Quality audit Negotiating and managing	Quality audit Negotiating and managing	Quality audit Negotiating and managing
Component level costs	N/A	N/A	Tooling cost
Order level costs	N/A	Ordering opening line Invoicing	Ordering opening line Invoicing
Batch level costs	Ordering Invoicing Importing Supplier accounting Receiving Inspecting Refusing Throwing away Sending back Incoming credit note Material handling to warehouse Late delivery Troubleshooting Repairing Re-testing	Ordering subsequent lines Importing Supplier accounting Receiving Inspecting Refusing Throwing away Sending back Incoming credit note Material handling to warehouse Late delivery Troubleshooting Repairing Re-testing	Ordering subsequent lines Importing Supplier accounting Receiving Inspecting Refusing Throwing away Sending back Incoming credit note Material handling to warehouse Late delivery Troubleshooting Repairing Re-testing
Unit level costs	Inventory holding (normal and early delivery) Price Complaint handling Outgoing credit note	Inventory holding (normal and early delivery) Price Complaint handling Outgoing credit note	Inventory holding (normal and early delivery) Price Complaint handling Outgoing credit note

possible problems with any application of ABC in general, and ours in particular. We would, however, argue that the use of ABC is already an advance as it approximates the linearity of the cost functions much better than the traditional volume related approaches, by using a cost hierarchy where costs have different explanatory variables in the costing hierarchy. Costs that were previously considered fixed or falsely considered variable at the unit level, can now become variable at one of the other levels in the hierarchy. In our particular case we have three further reasons why the application of ABC may not be that problematic. First, we have made a deliberate attempt to reduce measurement error in units of allocation bases (Datar and Gupta, 1994) by not asking for too detailed information of personnel in their time allocation estimates. Second, as will become clear from our result section, important parts of the possible savings (between 3% and 11% of TCO of the current purchasing policy) are immediate cash savings on price for which there cannot exist any measurement or accounting error. We acknowledge, however, that the other part of the savings may require a thorough re-engineering exercise to actually get rid of the freed up capacity or put it to an alternative use. Third, and most important, no joint resources are (or needed to be) included in our ABC exercise since only those resources for which the resource consumption is different if different suppliers are used are included in the model, as it is our objective to select those suppliers that minimise TCO. Because of the focused scale of our ABC exercise, we did not have to deal with joint resources such as investments in marketing and the brand name of the firm, as they do not vary with the supplier selection policy, which is our cost object.

4. The mathematical programming model

It is impossible to optimise the supplier selection and inventory management decision by taking all the relevant costs throughout the entire value chain of the firm into account in a simple spreadsheet. Therefore, we develop mixed integer mathematical programming models to determine an optimum sourcing strategy for the different component groups. The models generate a purchasing policy that minimises the Total Cost of Ownership taking into account constraints relevant to the problem. As a result, the quantification of the vendor selection criteria and the trade-off between them is no longer a problem because the objective function is defined as the TCO related to the purchasing decision, and the supplier selection criteria are weighted by their respective ABC costs.

Typically, a mathematical programming model consists of two main building blocks: the objective and the constraints. The objective of the model is to minimise the Total Cost of Ownership of the supplier selection and ordering policy for the decision period of the year. As discussed in the previous section, the structure of the models is based on case specific ABC hierarchies. This is shown in the objective function as it reflects net prices and resources consumed by the activities in the three to five hierarchical levels distinguished: supplier, component, order, batch and unit level. Subsequently, the mathematical programming model defines the costs incurred on each of these levels and establishes cost drivers as decision variables on all of these levels. The most important constraint for this procurement model is that demand for each component in each time period has to be satisfied.

A more detailed explanation of the mathematical programming models, the exact mathematical notation and information on the solving procedure can be found in the Appendix to the paper.

5. Results

We have made an extensive comparison of our suggested purchasing policy with the actual purchasing policy used. As we are not allowed to make the actual data available due to confidentiality reasons, we present the results in Table 4 as percentages. The first row indicates the possible savings as a percentage of the TCO of the current policy. The second row gives the approximate TCO figures for the different component groups in euro. The next eight rows show the hierarchy of costs for the optimal purchasing policy, as percentages of the optimal TCO. The final seven rows indicate how the cost hierarchy is built up for the current policy, as percentages of the optimal TCO.

The purchasing policy proposed is able to save 14%, 6% and 11% on TCO on the component groups resistors, transformers and PCBs respectively, compared to the current purchasing policy.[6] As the benefits of applying the vendor selection model can be measured in terms of the possible

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[6] These possible savings percentages are calculated for the last year for which full data were available. The TCO model is used to retrospectively calculate the cost of the purchasing policy for that year by fixing all the decision variables (when what was bought from which supplier) in the model to the values they took in that particular year's purchasing policy. In this way, we can calculate the TCO of the purchasing policy that was executed that year (termed 'current policy'). We then run the mathematical programming model again, this time to solve for the optimal policy and compare the total cost of both (savings indicated as a percentage of the TCO of the current policy). These savings could have been obtained had the company used the new method to determine purchasing policy in that year instead of using the purchasing policy they actually implemented. Because the firm faces a quite stable demand environment for these component groups, we can predict a level of savings of a similar size for the next year.

Table 4
Results

		Resistors	*Transformers*	*PCBs*	*Total*
Possible Savings	As a percentage of TCO of current policy	14.26%	5.97%	11.00%	8.49%
Optimal TCO	in Euro	1,151,000	7,974,000	4,827,000	13,952,000
Optimal policy as a % of optimal TCO	optimal TCO	100%	100%	100%	100%
	SLC	1.76%	0.42%	0.33%	0.50%
	CLC	N/A	N/A	0.06%	0.02%
	OLC	N/A	0.03%	0.03%	0.03%
	BLC	3.96%	1.21%	0.51%	1.19%
	ULC	94.82%	98.34%	99.06%	98.25%
	PURC	92.82%	97.71%	98.52%	97.58%
	INV	1.46%	0.63%	0.54%	0.67%
Current policy as a % of optimal TCO	SLC	2.28%	0.43%	0.37%	0.56%
	CLC	N/A	N/A	0.08%	0.03%
	OLC	N/A	0.03%	0.03%	0.03%
	BLC	6.61%	2.03%	0.79%	1.98%
	ULC	107.75%	103.86%	111.09%	106.68%
	PURC	106.33%	100.87%	109.02%	104.14%
	INV	1.42%	2.99%	2.07%	2.54%

savings compared to the current purchasing policy, this methodology overcomes the concern raised by Foster and Gupta (1997) about the difficulty of quantifying benefits if new management accounting systems have to stand the cost/benefit test.

Several strategic insights can be gained form the analysis of the data and the solving of the mathematical programming model.

As is to be expected in any purchasing application of ABC, the cost structure is unit level dominated, since the whole turnover is taken into account on this level. Price, a unit level cost, remains an important component of the TCO, in the optimal case making up between 92% and 98% of TCO. As most of the purchasing entailed activities (as defined in Figure 1) that have cost drivers at a higher level in the hierarchy are non value adding activities, a cost structure dominated by price is good business practice in this case. Most of the costly value adding activities, such as the different steps in the production process, were not included in the analysis as supplier performance does not make a difference to the use of their activity drivers. It could, however, be this type of activities that might shift the cost structure from unit level dominated to batch level dominated. The dominance of unit level illustrates the importance of getting the unit level costs right, also in an ABC environment where several other levels are studied. Table 4 also shows that the optimal policy cuts down on these non-value added activities compared to the current policy.

Most of the possible savings also lie at unit level.[7] Immediate cash savings could amount to savings of 11.5%, 3% and 9% respectively by selecting a supplier with a lower price and making optimal use of component specific discounts for transformers and especially PCBs. We acknowledge that this is not an effect directly related to our ABC implementation, but more a consequence of the operations research aspect of our methodology that brings in more structure and objectivity. Using this TCO model, the selection of these lower price suppliers can now be made with the assurance that quality and other costs are taken into account and that the overall effect on TCO is positive. Almost all components have a single source that is clearly better than the other possible suppliers. The current policy increases TCO by splitting orders of the same component over several suppliers and therefore does not make optimal use of the available quantity discounts.

In the rest of this section we report on non-cash savings that amount to 2.7%, 3% and 1.7% respectively. These are possibilities to save on resources, which would require a re-engineering exercise to turn them into cash savings. Alternative allocations and selling off of resources would need to be considered.

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[7] One could think about the benefits of ABC in this setting as those savings made on higher levels than unit level and that therefore the ABC part of the methodology was less important. We would argue, however, that while we can split out the cost savings over the different hierarchical levels, we cannot split out which cost savings are resulting from the ABC analysis, the mathematical program or simply the introduction of some objectivity by an outsider. For example, some of the unit-level savings relate to inventory holding. The ABC analysis brought more accuracy on the cost rate of holding a unit in inventory, the objectivity of the outsiders helped in aligning the various databases used and coming up with the correct vendor lead time and the mathematical program optimised the or-

For transformers and PCBs, substantial savings on inventory holding costs (also on unit level) are possible by ordering with suppliers who do not have a record of early deliveries, and by placing orders just in time for the suppliers lead-time to be sufficient to deliver the component exactly when needed. This saves a lot on warehousing costs that do not add any value to the component. The savings we find here are partially due to the main purchasing information system (PMS) not being updated regularly with respect to vendor lead times, that had a tendency to decrease over time, and were only correctly written down in the respective purchasing engineers own spreadsheets that were not linked to PMS. As a result, the automatically placed orders were placed too early. Part of these inventory holding savings could also be considered cash savings as there is a one-off freeing up of working capital due to a lower inventory level. For components with a low unit price such as resistors, inventory holding costs already make up a smaller percentage of the cost structure.

Savings can also be made on the batch level, by reducing quality problems for transformers and PCBs. In our opinion, the savings created by a smaller percentage of expensive defects often outweigh the cost of a quality audit. The batch level cost savings for resistors, for which quality problems are not common, are a result of a policy of less frequent ordering.

The firm can only make minor savings at order level costs for transformers and PCBs. Rather surprisingly, the possible way of ordering through EDI, ACO or fax, do not save much on ordering costs for the time being. The reason for this is that the cost differences between these ordering techniques are small since the EDI system in place still requires checking every order confirmation line by line, as the supplier can change quantities and prices without the purchaser immediately noticing this. This is an example of an area where the ABC results had an important policy impact as previously management had assumed that EDI was the most cost-efficient way of ordering and pushed EDI systems take-up with their suppliers. They decided to first sort out the technical aspects of the EDI system and automate order confirmation checking, before stressing its importance in negotiations with suppliers any further.

The component level for the PCBs turns out to be insignificant since the tooling costs that are charged whenever a PCB is ordered for the first time with a particular supplier, are small relative to the other costs, and often even non existent. Only minor savings are possible.

Because the purchasing engineers spend most of their time on the specifications for the components, which are independent of the suppliers selected, the supplier level costs do not make up a substantial amount in the cost hierarchy. Narrowing down the supplier base can result in savings at supplier level. The proposed supplier selection policy narrows down supplier bases from 21 to 17, from 37 to 35 and from 16 to 13 for resistors, transformers and PCBs respectively.

Since non-price costs make up between 3% and 9% of the cost structure, and still between 2% and 8% in the proposed purchasing policy, it would be interesting to investigate a broader use of vendor managed inventories (VMI), also called consignment stocks, as this cuts down costs of activities performed in the value chain of the purchasing firm and eliminates some of these activities.[8]

5.1. *Summary of findings*

In summary, our recommendations to management to reduce the TCO of their supplier selection policy were the following: narrow down the supplier base; select some lower price suppliers with the assurance that quality and other costs are taken into account in the model; make better use of discounts for transformers and PCBs; rely on a single sourcing policy on the level of each component (not for the whole component group!), on top of penalising late deliveries (which is already purchasing policy), also penalize early deliveries as inventory holding costs are high; reduce quality problems for transformers and PCBs, order less frequently for resistors, look into the possibility of extending the use of VMI and search for improvement in the EDI system.

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[8] At the time of writing, the firm is working on a pilot project for VMI with a supplier of a component group, not considered in this study. The consignment inventory is kept at or near the purchasing firm's site, but the inventory holding responsibility rests with the supplier as the components remain property of the supplier until the purchasing firm takes them out in agreed lot sizes. The supplier is responsible for keeping the components in stock in sufficient quantities to keep production going. His inputs for the replenishing of the inventory are forecasts directly from the purchasing firm's MRP planning, an agreed minimum and maximum stock level and component consumption data given by the production department on a weekly basis. The value chain of activities related to the purchasing process can thus be drastically shortened. Ordering is eliminated as the supplier draws his information directly from the company's MRP planning. Reception is also eliminated and incoming inspection is replaced by outgoing inspection. The supplier is responsible for material handling costs that includes transport to warehouse, removal of the packaging and shelving the duly labelled components on the assigned locations. The purchasing firm usually supplies the warehouse, but fire and water hazard insurance and warehousing personnel costs, also part of the inventory holding cost are for the supplier's account. The supplier finds compensation in cost cuts in his own production, a larger share of the business and increased partnership.

Apart from providing purchasing management with a better supplier selection and inventory management policy, the model can be used in two other ways. First, the model can give decision support using scenario analyses dealing with both strategic decision making and cost management issues. The TCO of alternative procurement strategies can be calculated, e.g. imposing a minimum or a maximum number of suppliers, excluding a supplier etc. Management then can decide whether they are willing to pay the increase in TCO compared to the optimal supplier selection policy to pursue these strategies. Areas can be identified where internal improvements such as reducing cost driver rates of performing value-added activities and/or eliminating non-value added activities, such as moving materials, can generate the highest reduction in TCO.

Second, areas where external improvements by suppliers are also able to generate decreases in TCO can be pinpointed. The model can then be used as a negotiation tool with suppliers since proposals of discounts, quality improvements, lead-time reduction etc. made by suppliers can be easily assessed. This clear communication on what drives costs in the purchasing firm will enable companies to develop inter-organisational activity-based management opportunities, given the importance of close relationships between the purchaser and a limited number of reliable suppliers that might lead to buyer-supplier partnerships. Sharing of cost information and cost savings can be made possible via this tool.

6. Conclusion

In this paper we develop a Total Cost of Ownership supplier selection methodology using Activity-based Costing data. In a first step, the activities in the value chain that relate to the purchasing policy are analysed. Next, resources available to perform all these activities are examined and resource drivers linking them are established. Once the costs of performing the activities are calculated, activity drivers that determine the total cost of the purchasing policy are defined, using case dependent cost hierarchies with three to five levels. Then, information is gathered on supplier performance on these activity drivers. Since a spreadsheet cannot encompass all these costs, let alone optimise the supplier selection and inventory management policy, mathematical programming models minimising the TCO of the purchasing decision are programmed and solved with a stepwise procedure. The ABC hierarchy forms the backbone of the mathematical programming model, with decision variables on each level of the hierarchy. Possible savings of between 6% and 14% are obtained for the three cases.

Along the way, several other lessons for accounting were learned. First, the problem of ABC not being applicable to joint costs (Noreen, 1991) does not need to be an issue in every case study. Here, the focus of the case was such that we did not need to include any joint costs since they do not vary with our cost object, the supplier selection policy. Second, we illustrate that the ABC hierarchy is case dependent, even for several component groups within the same firm. Third, people may hold subjective beliefs on rankings of costs of activities that may actually not be true. In this particular case, the belief that EDI ordering was (a lot) cheaper than ordering via the traditional fax way turned out to be wrong when the correct figures where put into the equation. Fourth, from an information systems point of view, we can re-iterate the need for regular updating of figures in all the decision models (e.g. as in this case in the EOQ model) to ensure correct decision-making and integration of all the databases used to avoid discrepancies between data. Fifth, this case study illustrates how survey evidence on the use of modern cost accounting concepts such as ABC may be positively biased. We think that, would management accountants within this firm have been asked to fill out such a survey, they would have ticked the ABC box. However, having dug into the details of their costing system, we would argue that a full-blown ABC system was not yet implemented.

There are several avenues for future research. First, the research reported on here studies off-the-shelf items. The biggest part of the purchasing entailed activities in the value chain that are dependent on performance of the suppliers are non value adding and thus the cost structure is dominated by unit level, although the savings generated by the ABC exercise on the higher levels are still important. It would, however, be interesting to build a similar model for a case study where more involvement of the suppliers is required in for example research and design. More value adding activities that are influenced by the suppliers would be included in the purchasing entailed value chain and higher ABC levels would gain in importance. Second, research into the quantification of opportunity costs of lost sales due to quality problems or late deliveries is difficult but would be useful in decision-making practice. Ittner (1994) reports on a few companies that make an effort on calculating quality related opportunity costs and quantifying the magnitude of lost sales.

Appendix
The details of the mathematical programming model.

Before stating the model, we provide a summary of the notation for later reference.

r : symbol referring to the resistors,
t : symbol referring to the transformers,
p : symbol referring to the printed circuit boards (PCBs),
n : index denoting resistors, $n=r$, transformers, $n=t$, or PCBs, $n=p$,
$N(n)$: set of resistors, $n=r$, transformers, $n=t$, or PCBs, $n=p$, index j,
K : set of monthly time periods, index k,
$S(n)$: set of suppliers for resistors, $n=r$, or transformers, $n=t$, or PCBs, $n=p$, index i,
$M(n)_{ij}$: set of discount intervals given by supplier i for component j, $\forall i \in S(n)$, $\forall j \in N(n)$, $n=t,p$, index m.

The parameters indicate the data required and all are expressed on an annual basis. As discussed in Section 3, the structure of the models is based on the case specific ABC hierarchy. At the first hierarchical level, the supplier level, the parameters describe costs incurred and conditions imposed whenever the purchasing company actually uses the supplier over the decision horizon. Unless otherwise stated, the parameters and expressions are valid for the three models, i.e. for $n=r,t,p$. The structure of the models differs from case to case as indicated in those paragraphs that are only valid for some of the component groups. We consider at supplier level:

qc_i : quality audit cost incurred by the buyer for the evaluation of supplier i, $\forall i \in S(n)$,
mh_i : annual hours of a dedicated purchasing manager for supplier i for the time devoted to managing and negotiating, $\forall i \in S(n)$,
wg : gross hourly wages of the purchasing manager who manages and negotiates with the suppliers,
mis : minimum number of suppliers to be used,
mas : maximum number of suppliers to be used,
slc : total supplier level costs.

For the PCB case we introduce a component level in the hierarchy. The parameters describe the costs incurred and the conditions imposed whenever the purchasing company actually buys the PCB. For $n=p$ we consider:

tlc_{ij} : tooling cost, $\forall i \in S(p)$, $\forall j \in N(p)$,
clc : total component level costs.

Each type of resistor is ordered separately and also deliveries are per type. However, orders for transformers and PCBs can include several types of components and are delivered in batches of the same type. Costs related to both the delivery and ordering of resistors are thus incurred at batch level, whereas for the latter component groups an order level is introduced to take ordering costs into account.

For transformers and PCBs we introduce an order level where the parameters indicate cost incurred and conditions imposed each time an order is placed with a particular supplier. For $n=t,p$ we consider:

vc : invoice cost per order,
oco : order cost per order for opening order line,
$olcs_i$: order level cost for supplier i, $\forall i \in S(n)$,
olc : total order level costs.

The batch level parameters indicate cost incurred and conditions imposed each time a batch is delivered by a particular supplier. For $n=r,t,p$ we consider:

tl_i : import duty per order from supplier i, $\forall i \in S(n)$; $tl_i = 0$ for European Union suppliers,
rc : reception cost per order,
ac : supplier accounting cost per order,
is_{ij} : inspection cost per order with supplier i of component j, $\forall i \in S(n)$, $\forall j \in N(n)$,
wr : material handling cost per order in transportation to warehouse and shelving,
rb_i : cost of returning an order to supplier i, $\forall i \in S(n)$,
ri : cost of re-inspecting a new delivery after a refusal,

pvi : probability of refusal at incoming inspection at vendor expense per order with supplier i, $\forall i \in S(n)$,
ic : cost of incoming credit note,
pi_i : probability of refusal at incoming inspection with incoming credit note per batch with supplier i, $\forall i \in S(n)$,
po_i : probability of refusal at incoming inspection and throwing away of component per batch of supplier i, $\forall i \in S(n)$,
ts : cost of troubleshooting, repairing and re-testing when defect of component is discovered during production,
ch : cost of complaint handling,
pif_i : probability of defect discovered during production per batch of component from supplier i, $\forall i \in S(n)$,
rp : cost of re-planning the production process,
$pl1_i$: probability of a late delivery by supplier i of less than 1 month late per order with supplier i, $\forall i \in S(n)$,
cl : cost of customer dissatisfaction due to late delivery,
$pl2_i$: probability of a late delivery by supplier i of more than 1 month late per order with supplier i, $\forall i \in S(n)$,
$blcs_{ij}$: batch level costs for supplier i and component j, $\forall i \in S(n)$, $\forall j \in N(n)$,
blc : total batch level costs.

For $n=t,p$ we consider:

ocl_{ij} : order cost per order line placed with supplier i for component j, $\forall i \in S(n)$, $\forall j \in N(n)$,
lc_{ij} : lot charge per batch with supplier i for component j, $\forall i \in S(n)$, $\forall j \in N(n)$.

For $n=r$ we consider:

oc_{ij} : order cost per order with supplier i of component j, $\forall i \in S(r)$, $\forall j \in N(r)$.

On the final hierarchical level, the unit level parameters specify costs incurred and conditions imposed related to the units of the components for which a procurement decision has to be made. For $n=r,t,p$ we consider:

p_{ij} : price of component j with supplier i, $\forall i \in S(n)$, $\forall j \in N(n)$,
dp_i : price discount as a percentage due to payment delay and conditions, $\forall i \in S(n)$,
$purc$: total monetary purchasing costs,
ocn : cost of outgoing credit note,
cq : cost of customer dissatisfaction due to quality problems,
pef_i : probability of defect discovered by external customer per unit of component from supplier i, $\forall i \in S(n)$,
eqc : total costs related to quality problems discovered by external customers,
h : inventory holding costs per period k as a percentage of the component's price,
ap_j : average price of component j, $\forall j \in N(n)$,
ls_{ij} : lot size for component j when bought with supplier i, $\forall i \in S(n)$, $\forall j \in N(n)$,
ame_i : average number of months, i.e. the number of time periods k, supplier i is early when he delivers early, $\forall i \in S(n)$,
pe_i : probability of early delivery for supplier i, $\forall i \in S(n)$,
$invc$: inventory costs,
bc : backlog costs, as explained infra.,
mo_{ij} : minimum order quantity in number of batches for component j when bought with supplier i, $\forall i \in S(n)$, $\forall j \in N(n)$,
b_j : beginning inventory of component j, $\forall j \in N(n)$,
d_{jk} : demand for component j in time period k, $\forall j \in N(n)$, $\forall k \in K$.

Transformers and resistor suppliers often offer component specific discounts when components are ordered in larger quantities. For $n=t,p$ we consider:

lb_{ijm} : minimum quantity to buy in discount interval m set by supplier i for component j, $\forall i \in S(n)$, $\forall j \in N(n)$, $\forall m \in M(n)_{ij}$,
ub_{ijm} : maximum quantity to buy in discount interval m set by supplier i for component j, $\forall i \in S(n)$, $\forall j \in N(n)$, $\forall m \in M(n)_{ij}$,

dc_{ijm} : price discount as a percentage given by supplier i for component j in discount interval m, $\forall i \in S(n)$, $\forall j \in N(n)$, $\forall m \in M(n)_{ij}$.

The decision variables can also be subdivided in the same hierarchical levels. The supplier decision variable models whether or not the purchasing company will use the supplier over the planning horizon. It is as follows; for $n=r,t,p$:

z_i = 1, if we buy from supplier i, 0 otherwise, $\forall i \in S(n)$.

The component level decision variable only exists in the PCB case, for $n=p$:

yk_{ij} = 1, if PCB j is ordered at least once with supplier i, 0 otherwise, $\forall i \in S(p)$, $\forall j \in N(p)$.

The order level decision variable only exists in the transformer and PCB cases. For $n=t,p$:

yj_{ik} = 1, if any component is ordered with supplier i in time period k, 0 otherwise, $\forall i \in S(n)$, $\forall k \in K$.

The batch level decision variable is, for $n=r,t,p$:

y_{ijk} = 1 if component j is ordered by supplier i in time period k, 0 otherwise, $\forall i \in S(n)$, $\forall j \in N(n)$, $\forall k \in K$.

The unit level decision variables pertain to the units of the components for which a procurement decision has to be made and are defined as follows, for $n=r,t,p$:

x_{ijk} = number of lot sizes of component j ordered with supplier i in time period k, $\forall i \in S(n)$, $\forall j \in N(n)$, $\forall k \in K$,

vi_{jk} = inventory of component j at the end of time period k, $\forall j \in N(n)$, $\forall k \in K$.

For the transformer and PCB cases two extra decision variables are introduced to model the component specific discounts, for $n=t,p$:

w_{ijkm} = 1 if component j is bought with supplier i in discount interval m in time period k, 0 otherwise, $\forall i \in S(n)$, $\forall j \in N(n)$, $\forall k \in K$, $\forall m \in M(n)_{ij}$,

xw_{ijkm} = number of batches of component j ordered with supplier i in discount interval m in time period k, $\forall i \in S(n)$, $\forall j \in N(n)$, $\forall k \in K$, $\forall m \in M(n)_{ij}$.

Table A.1 summarises how the main decision variables are associated with the hierarchical levels in the three cases.

Table A.1
The decision variables

	Resistors	*Transformers*	*PCBs*
Supplier level	z_i	z_i	z_i
Component level	N/A	N/A	yk_{ij}
Order level	N/A	yj_{ik}	yj_{ik}
Batch level	y_{ijk}	y_{ijk}	y_{ijk}
Unit level	x_{ijk}	x_{ijk}	x_{ijk}

With the notation given above, the mathematical decision model is described below.

Objective: minimise the Total Cost of Ownership of the supplier selection policy over the time horizon;

$$Min\ slc + clc + olc + blc + ulc \tag{1}$$

The objective function (1) reflects net prices and resources consumed by the activities in the five hierarchical levels distinguished.

Define the supplier level costs, for $n=r,t,p$;

$$slc = \sum_{i \in S(n)} \left(qc_i + mh_i wg\right) z_i \tag{2}$$

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The supplier level costs are incurred whenever the purchasing company actually uses supplier i over the planning horizon, i.e. z_i=1. The time spent by a dedicated purchasing manager on negotiating, managing and following up the relationship with supplier i can be put to some alternative use if supplier i is not chosen, i.e. z_i=0 nor does a quality audit need to be performed as the supplier is no longer kept in the supply base. What are called supplier level costs in this paper is often referred to as vendor-sustaining costs in the ABC literature (Cooper and Kaplan, 1998).

Define the component level costs for the PCB case, $n=p$;

$$clc = \sum_{i \in S(p)} \sum_{j \in N(p)} tlc_{ij} yk_{ij} \tag{3}$$

The component level costs are incurred the first time a specific PCB is ordered with a particular supplier and consist of tooling costs.

Define the order level costs for the transformers and PCB cases, $n=t,p$;

$$olc = \sum_{i \in S(n)} \sum_{k \in K} (oco + vc) yj_{ik} \tag{4}$$

The order level costs are incurred in those time periods k an order is placed with supplier i and are made up of ordering costs for the first order line and invoicing costs.

Define the batch level costs, $n=r,t,p$;

$$blc = \sum_{i \in S(n)} \sum_{j \in N(n)} \sum_{k \in K} blcs_{ij} y_{ijk} \tag{5a}$$

$$\begin{aligned} blcs_{ij} &= ocl_{ij} + lc_{ij} + tl_i + rc + ac + wr + is_{ij} + pv_i cv_i + pi_i ci_i + po_i p_{ij} \\ &\quad + pif_i ifc_{ij} + pl1_i rp + pl2_i cl \qquad \forall i \in S(n), \forall j \in N(n), n = t, p \end{aligned} \tag{5b1}$$

$$\begin{aligned} blcs_{ij} &= oc_{ij} + tl_i + rc + ac + vc + wr + is_{ij} + pv_i cv_i + pi_i ci_i + po_i p_{ij} \\ &\quad + pif_i ifc_{ij} + pl1_i rp + pl2_i cl \qquad \forall i \in S(r), \forall j \in N(r) \end{aligned} \tag{5b2}$$

$$cv_i = rb_i + tl_i + rc + ri + wr \qquad \forall i \in S(n) \tag{5c}$$

$$ci_i = rb_i + ic \qquad \forall i \in S(n) \tag{5d}$$

$$ifc_{ij} = ts + ch + {}^{p_{ij}}\!/_{ls_{ij}} \qquad \forall i \in S(n), \forall j \in N(n) \tag{5e}$$

The batch level costs are incurred only in those time periods k a batch of component j is ordered with supplier i resulting in a delivery, i.e. y_{ijk}=1. As is indicated in (5b1), (5c), (5d) and (5e), the batch level costs for the transformers and PCBs are made up of ordering costs *ocl*, lot charges *lc*, import duty *tl*, receiving costs *rc*, supplier accounting *ac*, material handling and shelving *wr*, inspecting costs *is*, the cost of discovering a default during incoming inspection *pv cv* + *pi ci* + *po p*, the cost of a quality problem discovered during production (internal failure) *pif ifc* and re-planning and customer dissatisfaction costs when a delivery is late *pl1rp* + *pl2cl*. The cost of discovering a default during incoming inspection consists of the costs related to refusing a delivery and sending it back at vendor expense *pv cv* in which case the supplier replaces the resistors that will have to be re-inspected, the costs related to refusing a delivery and receiving a credit note from the supplier *pi ci* and the price of throwing a defect resistor delivery away *po p*. Internal failure costs consist of troubleshooting, repair and retest costs *ts*, complaint costs *ch* and the price of the component $p/_{ls}$. We assume that the probabilities of discovering a default during incoming inspection and internal default apply equally over all batches of a component bought-in from a specific supplier. When a delivery is less than a month late only re-planning costs are incurred, but when there is more delay, the purchasing firm will have problems in delivering its products to its own customers. The batch level costs for resistors are very similar to those in the transformer and PCB cases, except that the order cost per line is now replaced by the full order cost *oc*, invoicing costs vc are added and lot charges *lc* are deleted, as indicated in (5b2), (5c), (5d) and (5e). Order costs for resistors, order costs per line for transformers and PCBs and inspecting costs are different for different components *j* with the same supplier *i* since they are dependent upon the type of agreement with the supplier for this specific component. Note that, in contradiction to EOQ models, part of the inventory related cost is recognised at batch level, as material handling cost per batch in transportation to warehouse and shelving costs are included on this level.

Define the unit level costs, $n=r,t,p$;

$$ulc = purc + eqc + invc + bc \tag{6}$$

Specifically, the unit level costs consist of the monetary purchase cost, the quality costs of defects discovered by external customers, inventory holding costs and backlog inventory costs.

Define the annual purchasing costs;

$$purc = \sum_{i\in S(n)} \sum_{j\in N(n)} \sum_{k\in K} \sum_{m\in M(n)_{ij}} xw_{ijkm}\left(1-dc_{ijm}\right)\left(1-dp_i\right)p_{ij} \tag{7}$$

The annual purchasing costs are equal to the sum of all purchases made from all suppliers, taking the component specific discounts and the payment delay and discount offered into account.

Define the external failure costs;

$$eqc = \sum_{i\in S(n)} \sum_{j\in N(n)} \sum_{k\in K} efc\ pef_i ls_{ij} x_{ijk} \tag{8a}$$

$$efc = ch + ocn + cq \tag{8b}$$

External failure costs are incurred when external customers of the firm discover a quality problem. They consist of complaint handling, making an outgoing credit note and cost of customer dissatisfaction due to quality problems. We assume the probability of external default applies equally to all units of a specific component bought-in from a specific supplier. For the cases considered here, however, external complaint records showed that none of the customer complaints about the final product related back to defect components delivered by the supplier. These problems were always discovered in earlier stages in the value chain, either in incoming inspection or during production. Thus, $pef_i = 0$, $\forall i\in S(n)$. Therefore there was no need for us to go into detailed calculation of the opportunity costs of lost sales due to customer dissatisfaction. However, this would prove a fruitful area for future research.

Define the inventory holding costs;

$$invc = \sum_{j\in N(n)} \sum_{k\in K} h\ ap_j vi_{jk} + \sum_{i\in S(n)} \sum_{j\in n(n)} \sum_{k\in K} h\ ap_j ls_{ij} x_{ijk} pe_i ame_i \tag{9}$$

The inventory holding cost applies to the total amount of component *j* held in inventory during each time period *k*, denoted by vi_{jk}, and to the components that are delivered early and thus have to be kept in inventory longer than necessary.

Define the backlog inventory costs;

$$bc = \sum_{j\in N(n)} \sum_{k\in K} (rp + cl)bl_{jk} \tag{10}$$

Backlog inventory is a term used in Operations Research (e.g. Winston, 1994, p.870). A backlog inventory is used whenever the demand for a component is not met in the time period the demand exists, but only in a later time period. It could be seen as a negative inventory. In the meantime, costs of re-planning the production process and a high cost of customer dissatisfaction due to late delivery are incurred. There is no cost of production standstill as the case study firm only starts producing when all necessary components are available. A backlog inventory could for example be used when a supplier who scores excellent on all other TCO issues doesn't have a short enough lead time. In this paper, however, we did not attempt to quantify the opportunity costs related to late delivery and customer satisfaction as this is an extremely difficult task. As demand in this case study is quite stable and predictable, we plugged in a prohibitively high figure for this cost so that when running the model well in advance of the time period considered, the optimal solution would never make use of the backlog inventory and order well in time with a supplier whose lead time is low enough to cover demand in time. The inclusion of a backlog inventory in the objective function, however, gives the decision maker the possibility to use the mathematical programming model also under circumstances of an uncertain demand, where flexibility and the possibility to deliver on a short lead time become extremely important. In this case, management should make several estimates of the opportunity cost of late deliveries and customer dissatisfaction and run the model again under these different scenarios. When there is a sudden change in the demand that was originally derived from the MRP system, the demand figures d_{jk} can be adapted from that time period k on and all earlier placed orders (before time period k) can be fixed in the model. When running the optimisation model again, it will choose these suppliers with a short enough vendor lead time to adapt to the new demand constraints or make use of backlog inventories that generate an opportunity cost to be included in the TCO.

This concludes the derivation of the objective function. The constraints relevant to the procurement problem are as follows.

Satisfy demand;

$$b_j + \sum_{i\in S(n)} ls_{ij} x_{ij(f-vlt_{ij})} - vi_{jf} + bl_{jf} = d_{jf} \qquad \forall j \in N(n) \tag{11a}$$

$$vi_{jk-1} + \sum_{i\in S(n)} ls_{ij} x_{ij(k-vlt_{ij})} - vi_{jk} + bl_{jk} - bl_{jk-1} = d_{jk} \qquad \forall j \in N(n), \forall k \in K|\{f\} \tag{11b}$$

The demand for each component in the first time period f, d_{jf}, modelled by constraint (11a), can be satisfied from either beginning inventory b_j, and/or from purchases from the potential suppliers, $x_{ij(f-vlt_{ij})}$, and/or be put in a backlog inventory bl_{jf} which is only satisfied in a later time period. The amount that remains is the end-of-period inventory vi_{jk}. When purchasing management wants a component to be delivered in this time period k by supplier i it will have to place this order in time period k-vlt_{ij}. f is equal to the maximum vendor lead time offered by a supplier of the component group studied. f determines how many time periods in advance the model has to be solved in a deterministic environment in order not to mount up the considerable cost of using a backlog inventory. In a stochastic environment where demand is uncertain, f can be used to fix the current time period and the orders placed before f, and re-run the model with the new demand data. Constraints (11b) model the demand for each component j in later time periods, d_{jk} and the backlog demand from the previous period, bl_{jk-1}, which adds to the normal demand in time period k. This demand is satisfied either from begin-of-period inventory, which equals the ending inventory of the previous period vi_{jk-1}, and/or from purchases from potential suppliers, $x_{ij(k-vlt_{ij})}$, and/or is put in a backlog inventory bl_{kj}. Again, the amount that remains is the end-of-period inventory, vi_{jk-1}.

Enforce the bounds on the number of suppliers used;

$$\sum_{i\in S(n)} z_i \geq mis \tag{12a}$$

$$\sum_{i\in S(n)} z_i \leq mas \tag{12b}$$

$$z_i \leq \sum_{i\in S(n)} \sum_{j\in N(n)} \sum_{k\in K} y_{ijk} \qquad \forall i \in S(n) \tag{12c}$$

$$y_{ijk} \leq z_i \qquad \forall i \in S(n), \forall j \in N(n), \forall k \in K \tag{12d}$$

Conditions (12a) and (12b) force the purchasing plan to have at least the minimum number, *mis*, and at most the maximum number, *mas*, of suppliers over the complete time horizon for each component group. Using constraint (12c), the decision variable z_i will be equal to 0 if the model suggests not to buy from supplier *i*, while constraint (12d) forces z_i to be equal to 1 if during some time period *k* an order has been placed with supplier *i*.

Enforce the proper relationships between x_{ijk} and y_{ijk} and impose the minimum order quantity;

$$x_{ijk} \le M\ y_{ijk} \qquad \forall i \in S(n), \forall j \in N(n), \forall k \in K \tag{13a}$$

$$mio_{ij} y_{ijk} \le x_{ijk} \qquad \forall i \in S(n), \forall j \in N(n), \forall k \in K \tag{13b}$$

If an order is not placed with supplier *i* in period *k*, condition (13a) with M a large number will ensure that the amounts of each component that can be bought from the supplier will indeed be zero. Since the minimum order quantity mio_{ij} is expressed as a number of batches, condition (13b) forces the batch size to be at least this amount if an order is placed.

Enforce the proper relationships between y_{ijk} and yj_{ik} for the transformer and PCB case, *n=t,p*;

$$yj_{ik} \le \sum_{j \in N(n)} y_{ijk} \qquad \forall i \in S(n), \forall k \in K \tag{14a}$$

$$nn\ yj_{ik} \ge \sum_{j \in N(n)} y_{ijk} \qquad \forall i \in S(n), \forall k \in K \tag{14b}$$

with *nn* the number of components, transformers or PCBs, to be bought. Condition (14a) ensures that if no component is bought in time period *k* with supplier *i* yj_{ik} is 0. Condition (14b) ensures that yj_{ik} takes the value of 1 when a component is bought with supplier *i* in time period *k*.

Enforce the proper relationships between y_{ijk} and yk_{ij} for the PCB case, *n=p*;

$$yk_{ij} \le \sum_{k \in K} y_{ijk} \qquad \forall i \in S(n), \forall j \in N(n) \tag{15a}$$

$$nk\ yk_{ij} \ge \sum_{k \in K} y_{ijk} \qquad \forall i \in S(n), \forall j \in N(n) \tag{15b}$$

with *nk* the number of time periods over the time horizon. Condition (15a) ensures that if, over the time horizon, component *j* is not bought with supplier *i*, yk_{ij} is 0. Condition (15b) ensures that yk_{ij} takes the value of 1 when component *j* is bought with supplier *i* over the time horizon.

Model the component specific quantity discounts, for *n=t,p*;

$$\sum_{i \in S(n)} \sum_{j \in N(n)} \sum_{k \in K} \sum_{m \in M(n)_{ij}} xw_{ijkm} = \sum_{i \in S(n)} \sum_{j \in N(n)} \sum_{k \in K} x_{ijk}$$

$$\forall i \in S(n), \forall j \in N(n), \forall k \in K \tag{16a}$$

$$ls_{ij} xw_{ijkm} \ge lb_{ijm} w_{ijkm} \qquad \forall i \in S(n), \forall j \in N(n), \forall k \in K, \forall m \in M(n)_{ij} \tag{16b}$$

$$ls_{ij} xw_{ijkm} \le ub_{ijm} w_{ijkm} \qquad \forall i \in S(n), \forall j \in N(n), \forall k \in K, \forall m \in M(n)_{ij} \tag{16c}$$

$$\sum_{i \in S(n)} \sum_{j \in N(n)} \sum_{k \in K} \sum_{m \in M(n)_{ij}} w_{ijkm} \le z_i \qquad \forall i \in S(n), \forall j \in N(n), \forall k \in K \tag{16d}$$

Expression (16a) computes the amount bought over all discount intervals. The lower bound on the amount of component j to buy in the discount intervals is set by constraint (16b), while constraint (16c) imposes the same condition for the upper bound. Condition (16d) ensures that we cannot obtain discounts on a component if we do not buy anything from the supplier. The discounting percentage is then applied in equation (7).

Integrality and nonnegativity;

$$z_i \in \{0,1\} \qquad \forall i \in S(n) \tag{17a}$$

$$yk_{ij} \in \{0,1\} \qquad \forall i \in S(n), \forall j \in N(n), n = t, p \tag{17b}$$

$$yj_{ik} \in \{0,1\} \qquad \forall i \in S(p), \forall k \in K \tag{17c}$$

$$y_{ijk} \in \{0,1\}, x_{ijk} \geq 0 \qquad \forall i \in S(n), \forall j \in N(n), \forall k \in K \tag{17d}$$

$$w_{ijkm} \in \{0,1\}, xw_{ijkm} \geq 0 \qquad \forall i \in S(n), \forall j \in N(n), \forall k \in K, \forall m \in M(n)_{ij} \tag{17e}$$

To conclude the model specification, constraints (17a) through (17e) impose the proper integrality and nonnegativity conditions that apply to the decision variables.

Model (1) through (17e) is a mixed integer linear programming model.

Table A.2 indicates the dimensions of the mathematical programming model, reporting on the number of variables and constraints, respectively, the mixed integer program uses when the input is read in.

Table A.2
Dimensions of the mathematical programming model

	Number of variables	*Number of constraints*
Resistors	117,125	95,231
Transformers	59,268	62,497
PCBs	31,456	28,904

Problems of a smaller size can be solved straightforwardly with optimising software such as LINGO (Schrage, 1998) on any IBM-compatible 486 or higher PC in times going from a few minutes to a few hours. The existing computer technology and software, however, does not allow to solve the case studies reported in this paper in a straightforward way because of the large dimensions.

Therefore, we have developed a stepwise procedure to achieve a good approximation to the optimal supplier selection and inventory management policy while analysing the data. In a first step, all components for which only a single source exists and for which therefore no better supplier selection is possible, are solved in separate models per supplier to optimise the ordering policy. Then a cluster matrix is drawn for all components that can be delivered by more than one supplier, which we called multiple sourcing components in the remainder of the paper. The cluster matrix indicates how many components the suppliers have in common and how they are clustered together around component groups. Mathematical programming models for small clusters of multiple sourcing components without links to other components or suppliers, can then be solved. The sequence in which the remaining big cluster of suppliers and multiple sourcing components is solved, starts with the suppliers with the least components and with the least links to other suppliers, for which the mathematical programming models can usually be solved for all components of a supplier in one go. Then we solve the optimising models for part of the components of the bigger suppliers.

For each group of components we include all the possible suppliers for these components, and proceed until we have solved models for all components. Each time the supplier level costs $slcs_i$ in the input of a subsequent mathematical programming model are set to zero if this supplier is already chosen in an earlier solved model to avoid double counting. For the transformer and PCB cases also the order level costs $olcs_{ik}$ are set to zero when in earlier solved models an order is already placed with supplier i in time period k, i.e. if $yj_{ik} = 1$. All the mathematical programming models are solved with an optimality tolerance between 0 and 3%. The optimality tolerance indicates to the branch-and-bound solver in LINGO that it should only search for integer solutions with objective values at least x % better than the best integer solution found so far. The results of modifying the search procedure in this way are two-fold. First, on the positive side, solution times can be improved enormously. Second, on the negative side, the final global solution obtained by LINGO may not be the optimal solution. However, a solution within x % of the TCO optimum is guaranteed. On larger mixed integer models like these, the alternative of getting a solution within a few percentage points of the optimum after several minutes of runtime, as opposed to the optimum after several days, makes the use of an optimality tolerance quite attractive. Using this procedure, the TCO reached might be slightly higher than the optimal TCO that could be reached if it were possible to solve the mathematical programming model for the whole component group at once, because the sequence of the components and the optimality tolerance percentage used influence the solution obtained. However, possible savings of between 6 and 14% compared to the current policy of the firm, discussed in the next section, prove this procedure definitely obtains good results. Going through this solution procedure on a yearly basis is sufficient. Selected suppliers can then be fixed and smaller models can be solved to generate the order and inventory policy only. The firm in this case study could decide to continue to use their existing EOQ model to determine the ordering policy on an operational basis and use the TCO model for strategic supplier selection decision making.

A simpler ABC hierarchy as the three level resistor hierarchy compared to the five level PCB hierarchy, does not help to solve the models in these cases more easily. Less hierarchical levels may lead to less decision variables, but in the cases studied here the number of possible suppliers that can deliver a component increases when the number of hierarchical levels decreases, and thus the number of variables is increased in that way again.

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Accounting for the activities of funerary temples: the intertwining of the sacred and the profane

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Abstract—This paper explores the role of accounting practices in the functioning of funerary temples (established to preserve the cult of important, dead individuals) from the Old Kingdom (2700–2181 BC), ancient Egypt. The paper identifies several roles played by accounting practices in this context, which involved the construction of various types of visibility: organisational, technical and dependency. Organisational visibility was manifest in the use of a combination of black and red ink in a grid, tabular format. Technical visibility involved the use of a noun-dominated limited vocabulary, various metrics of quantification and measurement, and a classification taxonomy. Dependency visibility clarified the linkages among various economic institutions and between them and the funerary temples as the latter drew on provisions supplied by the former. Accounting practices constructed funerary temples as both economic and spiritual institutions. There is also evidence to suggest that some abstract conceptualisation of accounting was entertained by the ancient scribes who used accounting entries as a means of reconstructing activities into newly created realities. The paper concludes by arguing that accounting practices were part of an intertwined sacred/profane assemblage that did not recognise either dimension as discrete.

1. Introduction

In most contemporary societies, human mortality or death brings with it a whole host of accounting interventions. The instance of death, particularly of the head of a household, triggers numerous accounting calculations and valuations. For example, wealth left by the dead is enumerated, counted, valued and distributed among those entitled to inheritance; incomplete transactions are finalised and closed; and inheritance tax is assessed. Moreover, significant resources tend to be pledged for death, not only for burial but also for preserving the memory of the dead. Yet, the role of accounting practices in the activities centred on the dead is little understood because the extant literature has focused upon the activities of the living in less morbid contexts.

Funerary institutions provide a unique and indelible link between the living and the dead. As funerary temples are run by the living seemingly for the benefit of the dead, a combination of unusual activities ensue whereby the sacred is intertwined with the routine of daily life. Spiritual activities, such as those of the priestly, are frequently intermingled with what has come to be viewed as the profane, such as maintenance work, organisation of temple personnel and provisioning for them. Exploring the role of accounting practices in such a unique setting could shed further light on our understanding of the role of accounting in organisations and society. We know precious little about how funerary temples were organised in previous civilisations, what kinds of accounting practices were used, and the extent to which the functioning of such institutions was underpinned by accounting practices. Similarly, little is known as to whether the dichotomy that some have drawn between sacred religious activities and profane accounting practices in the context of contemporary Western cultures (Laughlin, 1988; Booth, 1993) holds for other, particularly ancient cultures, or whether the sacred and secular were much more intertwined.

Durkheim (1976:37) has argued that religious thought models the world as being made of two distinct domains, 'the one containing all that is sacred, the other all that is profane'. The implication of such argument is that the domains of the sacred and the profane are clearly distinguishable and carefully demarcated with no overlap. As Jones (1986:142) has noted: 'Durkheim argued that all these forms [things] are reducible to two fundamental interdictions: the religious life and the profane life cannot coexist in the same place, and they cannot coexist in the same unit of time.' For Durkheim (1976), the sacred exhibited a characteristic 'the contagiousness of the sacred' that impelled it to escape its originals location and flow to any objects within its range, that is the sacred is greatly susceptible to become attached to the profane. To keep the sacred and profane worlds apart, a system of restrictions has to be developed and enacted. Even the work of influential religious writers such as Eliade (1959:26) shares this dichotomous view of the sacred and the profane, for he states that the sacred is created by 'detaching a territory from the surrounding cosmic milieu and making it qualitatively different'. Thus, even though Eliade acknowledges that the sacred is initially carved out of the profane, any possible continuity between the two is quickly annulled through the development of qualitatively different sacred attributes. Despite modelling some aspects of human behaviour on those of the gods, as a human 'imitates the paradigmatic gestures of the gods, repeats their actions, whether in the case of a simple physiological function such as eating or of a social, economic, cultural, military, or other activity', (ibid:98) these gestures are taken to simply allow humans to 'live in the presence of the gods' (ibid:105). Under this view, the sacred and the profane remain distinctly differentiated, as the sacred becomes 'the manifestation of something of a wholly different order, a reality that does not belong to our world, in objects that are an integral part of our natural "profane world" '(ibid:11).

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Based on the views of Durkheim and Eliade, Laughlin (1988) examines the role of accounting practices in the Church of England. His insightful analysis is nonetheless conducted with accounting construed as part of the profane dimension, seen in the context of the church as an unwanted intervention into the sacred domain. At the level of the parish church, accounting practices are 'highly rudimentary and are deemed highly irrelevant to the ongoing life of the parish' (ibid:23). At the level of the Diocese, accounting practices are reported to be much more elaborate, and only used to generate sufficient income to cover fixed expenditures, but never to question what was going on 'such that the sacred work could continue unhindered and untroubled by such matters' (ibid:33). This argument is so remarkably close to Durkheim's concern with the abyss that for him separated the sacred from the profane; those with sacred duties cannot perform them until they completely rid themselves of the profane. So profane was accounting considered, Laughlin claims, that its marginal role in the parish church was to be expected: 'parish accounting systems are rudimentary, precisely because they actually have no part to play in this *clearly demarcated* spiritual unit' (ibid:38; my emphasis).

Drawing on original historical material from ancient Egypt, the main aim of this paper is to question this supposed dichotomy, or clear demarcation, between the sacred and the profane, and the taken-for-granted assumption that accounting practices have no role to play in the domain of the sacred. Some researchers have noted their reservations concerning this demarcation even in more recent settings than those of ancient Egypt. In critiquing the work of Laughlin and Booth, Hardy and Ballis (in press, pp. 25–26) have suggested that the 'sacred and secular model remains problematic: it consists of general arguments that oversimplify religious organizations, on the one hand, and on the other, stereotypes the role of professionals in these organizations'. Jacobs and Walker (2004) have argued that the 'integrated spirituality' of the Iona Community perceived no separation of the sacred and secular. Quattrone (2004) has also noted that the development of accounting and accountability practices in the Society of Jesus in Italy (XVI–XVII centuries) was tightly linked to the absolutist ideology of the Roman Catholic doctrine of the Counter-Reformation. Hence, this paper explores the extent to which accounting practices were an essential part of the intertwined assemblage of the sacred and profane in ancient Egypt. In this sense, the paper's emphasis is different from recent studies that have sought to emphasise the economic rationales of accounting intervention in religious institutions (Flesher and Flesher, 1979; Swanson and Gardiner, 1988; Duncan et al., 1999; Lightbody, 2000),

The world of the ancient Egyptians was maintained as a precarious balance between three realms: the sky, the earth, and the netherworld, so that the supernatural was entwined with everyday life (Ezzamel, 2004). As Shafer (1998:1) has noted: 'These three realms converged in temples and cohered in rituals.' One of the distinguishing features of ancient Egyptian civilisation is its concern with death, conceptualised as a continuation of life or as a journey to life in the 'other world'. Committing resources to preserve the cult of the dead over time was an obsession for important individuals, in particular the Pharaohs (the word for kings in ancient Egyptian) for whom large funerary temples were built. Throughout the history of ancient Egypt, accounting inscriptions were used extensively to record funerary offerings. My concern in this paper is with the role of accounting in the functioning of funerary temples, as institutions where religious activities intermingled with accounting and administrative matters, during the Old Kingdom (2700–2181 BC).[1]

State and royal temples tended to be large in size and significant in terms of the scale of their building and maintenance work, the amount of their wealth endowments and the quantities of foodstuffs dedicated to them on a daily basis. The temples employed large numbers of personnel, ranging from the priesthood through administrators and scribes to craftsmen and unskilled labourers. The presence of large numbers of temple staff, some engaged permanently and others in rotation or shifts, organised in phyles, posed serious co-ordination and monitoring challenges to administrators. Moreover, priests were frequently appointed as custodians of endowments to funerary cults and were expected to act in ways stipulated by contractual relationships between them and the dead. Rations/wages, differentiated by occupation or rank, were calculated and distributed among the temple personnel. Funerary temples relied on various economic institutions for the provision of foodstuffs and other materials required for their functioning, and their revenues and expenditures had to be balanced carefully on a regular basis in order to ensure the continuity of their activities.

This paper seeks to examine the manner by which accounting practices intervened in such settings by focusing upon the calculations and inscriptions that emerged in the context of the functioning of funerary temples. My concern here spans two levels. First, understanding the role of accounting practices in the activities that occurred *within* the temple; in particular: (a) organising, measuring, monitoring and evaluating work undertaken in the temple; (b) underpinning the contractual relationship between the dead and the living priests, with the latter acting as custodians of temple endowments; and (c) securing appropriate provisions (rations) of different types of foodstuffs for temple personnel. Secondly, gaining an appreciation of the nature of economic relations that linked funerary temples with *outside* institutions that secured the regular provisions required for the functioning of these temples. Full translations of complete historical records are used as the primary sources, in addition to numerous secondary sources in the form of scholarly writing on ancient Egypt as well as relevant accounting literature.

The remainder of the paper is organised as follows. In the next section, I provide a brief discussion of royal power and the role of administration during the Old Kingdom. In Section 3, I consider some early examples of the role of accounting in temple activities, from the Third Dynasty to the early Fifth Dynasty, and show the involvement of accounting and scribes in a variety of activities, including temple endowments and the distribution of precise rations of foodstuffs among temple personnel. The inscriptions also show how responsibility for the management of temple land endowment was allocated among the temple priests, acting not only as spiritual leaders but also as economic agents or custodians for the dead. This is followed in Section 4 by an examination of some examples of the accounting entries in the Abusir Papyri concerning the daily life of the temple and the administrative redistributive system. The discussion in Section 5 indicates that several institutions were intricately linked together in a web of economic and social dependencies. The analysis also suggests that the functioning of these institutions for centuries was underpinned by accounting practices where the sacred intermingled with the profane. The concluding Section 6 brings together the main arguments of the paper and briefly explores their implications for the theorising of accounting.

2. Royal power and administration in the Old Kingdom

The aim of this section is to provide some background to the analysis that follows in the remainder of the paper. Given the focus on royal funerary temples, the section begins with a brief discussion of the dual role of the Pharaoh as god and king. To understand the role of accounting in funerary temples, it is important to locate accounting practices within the context of the administrative apparatus of the time, hence some discussion of administration in the Old Kingdom follows. Finally, some reference is made to the intertwining of religious and economic activities in funerary temples.

2.1. *The Pharaoh as God and King*

The roots of the concept of kingship in ancient Egypt date to the Predynastic period or even earlier; as Baines (1995:147) has suggested: 'From before "history" began, Egyptian society centred on kingship.' Once Egypt became unified, 'divine kingship had emerged as a coherent ideology' (Wilkinson, 1999:183). To legitimise his authority, the Pharaoh was linked directly to Egyptian gods. A relationship of mutual dependence developed between the Pharaoh and the clergy whereby each promoted and protected the interests of the other. Through religious practices such as prayers and coffin/tomb inscriptions, the priesthood sought to

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[1] For Egyptologists, sometime around 3300 BC (when the Southern and Northern parts of Egypt were united) separates prehistory from history. Prehistory dates from the Old Stone Age (before 18000 BC, Grimal, 1992) or even much earlier (Midant-Reynes, 2000). History has been divided into Predynastic and Dynastic periods. The Predynastic era includes Dynasties Zero to II, while the Dynastic era covers Dynasties III–XXX (Dynasty Zero has been inserted recently following new discoveries). The Dynastic era has been divided into: the Old Kingdom (III–VI); the Middle Kingdom (XI–XII); the New Kingdom (XVIII–XX); and the Late Dynastic Period (XXI–XXX). The Dynasties missing from this classification, known as the Intermediate Periods, were times of turmoil when Egypt ceased to function as united country.

inculcate the Pharaoh as being indispensable to the survival of Egypt.

The pyramid texts of the Old Kingdom reveal the awe-inspiring images in which the dead king was held. Upon death, the king was proclaimed to ascend from his grave to the sky to become a star, to join the sun-god, to be identified with gods and to become a super deity. The dead Pharaoh was represented as immortal: 'I escaped my day of death just as Seth[2] escaped his day of death' (Utterance 570, Faulkner, 1969:224). Incorporated into these seemingly purely religious texts were pronouncements affirming the 'legitimate' heritage of the Pharaoh as the unquestioned and universal ruler of Egypt:

> '...I am the Unique One, the Bull of the sky, I have crushed those who would do this [harm] against me and have annihilated their survivors. That which appertains to my throne, which I have taken and lifted up, is this which my father Shu[3] gave me in the presence of Seth.' (Utterance 254, Faulkner, 1969:64)

The power of the Pharaoh was thus invested in godly authority (Shu and Seth) as a matter of divine right, an image reinforced through royal regalia (e.g. crowns, sceptres), iconography as symbols of royalty, and artistic representations of the king crushing his enemies. The Pharaoh assumed numerous titles reflecting power and divinity, further reinforced by carefully staged rituals and festivals, and imposing palaces, tombs and funerary temples, and was considered the conduit between the gods and his subjects. As Hornung (1997: 283) has noted: 'the social pyramid of humanity, as seen by the Egyptians, culminated in the king. He was closest to the gods and belonged rather in their world, being 'indistinguishable' from them. Thus, in one of his aspects the king was a god and received cultic worship. In his other aspect, however, the king was the protagonist of the cult and hence the representative of humanity vis-à-vis the gods.' This dual concept of kingship coupled with the importance of the 'other life' led to the emergence of large royal funerary temples to promote and perpetuate the cult of the Pharaoh.

2.2 *Administration in the Old Kingdom*

With the unification of Egypt came a powerful central administration: '[A]dministration was now conducted on a national scale ...a centralised administration provided a stabilising influence and, critically, a guarantee of emergency relief in times of famine through the maintenance of central stocks of grain' (Wilkinson, 1999:111–112). Original material on the socio-political, economic and administrative structures of the Old Kingdom is sparse. Observations made by scholars have been in the main based on unconventional sources, such as seal impressions (Hayes, 1990), inscriptions and scenes on tomb vessels, and texts on tomb walls.

Such evidence, however, suggests that the emergence of administrative practices in ancient Egypt preceded the Dynastic era: in the late Predynastic era writing has been linked to administration, in particular detailed record-keeping (Postgate et al., 1995). There is also evidence of some official titles designating specific tasks, such as *nbi* which implies responsibility for managing the royal domains (Wilkinson, 1999:112). The use of seals containing Hieroglyphs of royal names designated ownership of objects by the Pharaoh or the state, and some seals identified certain goods, such as oil, as tax (O'Conner, 1987: 33). Bard (1992:301) notes that: '[T]he texts on mid-Dynasty labels... present information of a political nature set in a calendric framework, followed by the royal *serekh* [seal] and titles, officials' names and titles, and specifications of contents in the jars to which the labels were affixed. Here the Hieroglyphic writing serves yet another function: to name the administrators of the state within the framework of the year name.' Hence, the seals differentiated officials by name, title, responsibility and designated them temporally.

In Predynastic Egypt a religious calendar was developed and, in the Old Kingdom, a civil calendar began to be used for dating events and administrative activities (Hayes, 1990; Depuydt, 1997). The civil calendar provided for a year of 365 days made of three seasons of four 30-day months each, plus five epagomenal days added at the end of the year. The three seasons were *Akhet* (Inundation) commencing with the inundation of the Nile, *Proyet* (Growth) referring to the fields being prepared and planted with seed once the Nile water receded, and *Shomu* (Harvest) when crops were ready. The five epagomenal days were festivals devoted to the gods of the Egyptian pantheon. It was not, however, until the Old Kingdom, and more specifically the reign of King Djoser (Third Dynasty), that a key discontinuity occurred in the development of administration. It was then that the *tjaty* (vizier) assumed responsibility for running the Country on behalf of the Pharaoh (Grimal, 1992). The Third Dynasty was also 'marked by the establishment of a more structured administration, comprising different departments each with its own bureaucracy. For the first time, all branches of government may have been brought together in one location, at Memphis' (Wilkinson, 1999:112).

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[2] Seth was a God endowed with phenomenal power and was associated mainly with Upper Egypt (Watterson, 1996, : 102). Seth also figures in Egyptian mythology as the evil God who killed his brother Osiris to take the throne of Egypt. Seth was later defeated by Horus, son of Osiris, who reclaimed the throne of Egypt as the legitimate heir to his father (Clark, 1978; Hare, 1999).

[3] Shu was a cosmic deity, the God of Air and Light, and from whose union with the Goddess Tefnut, the sky (Goddess Nut) and earth (God Geb) were born to signify the creation of the world (Watterson, 1996: 31).

This administrative apparatus, widely believed to have developed out of the royal palace (Khurt, 1997), had two key elements: the division of Egypt into a number of provinces or nomes in the Third Dynasty, and the determination of specific official offices or occupations. Some Egyptologists (e.g. Kanawati, 1980; Strudwick, 1985) have attempted to piece together the key features of the administrative structure of the Old Kingdom from official titles. For example, Strudwick identified six major titles: the vizier and the overseers of each of the great mansions; the scribes of the king's documents; works; the granaries; and the treasuries. While this approach has yielded helpful insights, care should be exercised in equating titles with office, because frequently titles were symbolic in nature. However, it is clear that the hierarchy of administration was headed formally by the Pharaoh followed by the vizier, supported by various administrators and scribes, who was held responsible for four key domains: the treasury; agriculture; the royal archives and justice (Grimal, 1992).

The dominant view in Egyptology is that the economy of ancient Egypt was based on redistribution, that is the administrative machinery of the state collected produce in order to redistribute it in some manner among its subjects (e.g. Janssen, 1975a; 1975b). Such a view assumes that all productive forces, such as land, mines, etc. were owned by the Pharaoh (e.g. Wilson, 1951). The trouble with this view is that available evidence is too sparse to allow drawing such definitive conclusions. For example, there is little evidence available on the juridical regime of land in ancient Egypt. It is not clear from the scant evidence available how much land was really 'owned' by Pharaoh nor what that concept of ownership entailed. It is not until the Ramesside period, and in particular the Twentieth Dynasty, that we begin to have some detailed evidence on land tenure in ancient Egypt (Katary, 1989), contained in the Wilbour Papyrus (Gardiner, 1948), followed by more evidence on private ownership in Roman Egypt (Rowlandson, 1996). Hence, the view that the 'Pharaoh owned all land in Egypt' remains unsubstantiated as it rests predominantly on assumptions. Such statements may have been rooted in a constitutional tenet, just as in the case of the UK today, and it may therefore be unlikely to shed much light on land ownership in ancient Egypt.

2.3. The temple as a site of religious and economic activities

In the context of ancient Egypt, the term 'funerary temple' is by no means straightforward. Temples were seemingly built for gods (divine), kings and important officials (royal, funerary or mortuary). However, a closer inspection of the structure and activities of both types of temple (i.e. those built for gods and those built for kings) indicates that such binary distinction is problematical, as some parallel activities were carried out in both types (e.g. Haring, 1997; Quirke, 1997; Haeny, 1998). While bearing this in mind, the term 'funerary temple' is used here to designate primarily but not exclusively temples built to celebrate and promote the cult of dead kings and important officials. Funerary temples have been dubbed 'divine households' (Haring, 1997). It was in these temples that the dead Pharaohs, conceptualised as 'gods', and the gods themselves had their home, and where they were 'venerated and cared for by priests' (ibid:v). Moreover, some Egyptologists have tended to treat the economy of the temple as something similar to that of the household of a high official, with the resources and personnel being organised with the aim of sustaining the owner and his family (Helck, cited in Haring: 1). As Haring (ibid) has noted, the concept of household as applied to the temple is not purely symbolic but has a literal meaning: 'the statues that stood in closed shrines in the dark innermost parts of the temple were not tokens, but living images. They were bodies fashioned by craftsmen, and the gods entered into them in order to rest… in the temple.' By acting as the living personification of the dead kings, these statues each carried the name of the king and partook of the gifts laid before it (see Haeny, 1998:125).

In the Old Kingdom the temple had two interrelated roles; one religious and the other economic. Central (state) temples, as distinct from local temples, played the greatest roles in both religion and economy. Endowments were given by the Pharaohs to the temples, such as the Hathor-cult[4] at Thene, and earmarked as sinecure for the support of priests. Although Goedicke (1979) suggests that the Hathor-cult was established purely to legitimise kingship, rather than to satisfy communal religious needs, the very act of endowment, even if purely symbolic, highlights the responsibility felt by the king towards ensuring the economic survival of the temples and securing the preservation of the cults of his family and important royal followers. As the king:

> '…was envisaged as destined for a meaningful afterlife, those who have been affiliated with the King on earth expected, to an increasing degree, to follow their earthly lord and to enjoy a hereafter with him.' (Goedicke, ibid:120).

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[4] Hathor was a Goddess symbolising fertility (Watterson, 1996: 113).

Such religious and spiritual aspirations do not occur in a vacuum but their fulfilment has significant economic and administrative consequences:

> 'Such extended funerary care, however, required administrative and economic preparations, especially as the continuation of existence beyond death was seen as depending on permanent physical care and provisioning. This task, like the maintaining of the royal court and its members and dependents, was the concern of the royal economy, which supported the funerary needs of the royal followers entered in closely defined cemeteries.' (ibid:120–121)

It is the role of this royal economy in the functioning of funerary temples and the intervention of accounting practices therein that this paper seeks to identify and examine more fully.

3. Early examples of the role of accounting in the temple

The scribes recorded a wide variety of activities involving funerary offerings to subjects favoured by the Pharaoh as a means of rewarding their achievements. An example dates from the reign of Senefru, Third Dynasty (Breasted, 1906/1988: 75–79) whereby Methen, the chief scribe of the provisions magazine and the holder of a host of other titles, was to receive a house 200 cubits long and 200 cubits wide[5] with a large lake. In addition:

> 'There were conveyed to him as a reward 200 stat [*aroura*][6] of lands ... and a mortuary offering of 100 loaves every day from the mortuary temple of the mother of the king's children, Nemathap...A vineyard was made for him: 2,000 stat of land within the wall: trees were set out.' (Breasted, 1906/1988:77–78)

On the face of it, the above text appears to be no more than a simple listing of objects and quantities. Yet, such an apparently simple inscription would have relied upon a number of calculations. The endowment of a large house, 200 stat of (presumably agricultural) land and a vineyard of the size of 2,000 stat would have required some measuring. Moreover, the stipulation of a daily offering of 100 loaves of bread from the mortuary temple of the king's wife would have had to take into account the daily revenues and expenditures of that temple before the offer could be guaranteed. This royal offering to Methen would have set in motion various calculations to *determine the magnitude* of the royal reward to an important official as befit the Pharaoh. Moreover, it would have also triggered a whole set of practices to ensure the *delivery* of the offerings for as long as was intended.

Officials who were the recipients of funerary endowments were able to emphasise their ownership and control over land and to stipulate specific punitive measures against priests who were entrusted with the management of the endowment for the benefit of the mortuary cult. In an inscription from the reign of king Khafre (Fourth Dynasty) an official whose name is lost states (Breasted, 1906/1988:92):

> 'I have not empowered any mortuary priest of the endowment, to give the lands, people or [anything which I have conveyed to them, for making mortuary offerings to me], therewith in payment to any person; or to give as property to any person...Whatsoever mortuary priest of the endowment shall violate.... of my mortuary offerings, which the king gave to honor me, the portion in his possession shall be taken from him... Whatsoever mortuary priest of the endowment shall institute legal proceedings against his fellow, and he shall make a writ of his claim against the mortuary priest, by which he (the defendant?)[7] forfeits the portion in his possession; the lands, people and everything shall be taken from him, which I gave to him for making mortuary offerings to me.'

The remainder of the inscription shows that this official instructs 10 temple priests to take out whatever payments that had to be made against his endowment, in the form of approved liabilities, and '[t]he portion which remains afterward, shall belong, by 10ths, to those (priestly) orders' (ibid:93), so that each of the 10 priests would have been entrusted with the management of 1/10th of his net funerary endowment. Even though these inscriptions were not legal documents, they could have served to initiate legal proceedings in the form of writs. From a control perspective, they provide evidence of ownership which allows the owner to discipline his managing agents, even though they may be powerful priests, by reclaiming the endowments back from them should they deviate from his precise instructions. These inscriptions relating to the cult of the dead were not purely ceremonial but were also the embodiment of a whole set of economic relations. They were *intended* to trigger *action* whenever these economic relations were violated.

The Fifth Dynasty offers more detailed evidence on the role of accounting in temple activities. The remainder of this section examines the land endowment of Nekonekh (Table 1), whereas Sections 4 and 5 deal with the Abusir Papyri.

Table 1 shows a tabular format in which the scribe carefully arranged his entries to cover: (i) an initial listing of the names of temple priests; (ii) the period of time covered (a full year) against the

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[5] One 100 square cubits = 27.565 square meters; see Clagett (1999: 12).

[6] One stat, or *aroura*, equals 2,735 square meters, or about two thirds of one acre (Clagett, 1999: 12).

[7] Words enclosed in () indicate uncertain meanings.

Table 1
Land endowment of Nekonekh*

<table>
<tr><td colspan="2" rowspan="2">King's-confidante, Hezethekenu, revered (woman)</td><td colspan="2">Five intercalary days</td><td>Land</td></tr>
<tr><td>1st month</td><td rowspan="4">First Season</td><td>5 stat</td></tr>
<tr><td colspan="2">Scribe of the King's records, Henhathor (man)</td><td>2d month</td><td>5 stat</td></tr>
<tr><td colspan="2">Shepseshathor, ⌜priest⌝ (man)</td><td>3d month</td><td>5 stat</td></tr>
<tr><td colspan="2">Nessuhathoryakhet (man)</td><td>4th month</td><td>5 stat</td></tr>
<tr><td colspan="2">Shepseshathor, ⌜priest⌝ (man)</td><td>1st month</td><td rowspan="4">Second Season</td><td>5 stat</td></tr>
<tr><td colspan="2">Webkuhathor ([<i>Wᶜb-kᵓw-</i>] <i>Ḥtḥr</i>) (man)</td><td>2d month</td><td>5 stat</td></tr>
<tr><td colspan="2">Kisuthathor (<i>Ḳᵓ-yśwt-Ḥtḥr</i>) (man)</td><td>3d month</td><td>5 stat</td></tr>
<tr><td colspan="2">Khebuhathor (<i>Ḫᶜ-bᵓw-Ḥtḥr</i>) (man)</td><td>4th month</td><td>5 stat</td></tr>
<tr><td colspan="2">Khentisuthathor (<i>Ḫnt-yśwt-Ḥthr</i>) (disappeared)</td><td>—</td><td rowspan="5">Third Season</td><td>5 stat</td></tr>
<tr><td colspan="2">Royenet (<i>Rᵓ-yn·t</i>) (disappeared)</td><td>—</td><td>5 stat</td></tr>
<tr><td colspan="2">Left vacant (disappeared)</td><td>—</td><td>5 stat <i>sic!</i></td></tr>
<tr><td colspan="2">— meat, his tenth of all that is paid [into] the temple, beside the rations of bread and beer.
Prophet, Henhathor (man with libation vase)</td><td>3d month</td><td>5 stat</td></tr>
<tr><td>Mortuary Priest</td><td>Mer — (man)</td><td rowspan="2">4th month</td><td rowspan="2">5 stat</td></tr>
<tr><td>Mortuary Priest</td><td>⌜Keksire (<i>Kᵓk-sᵓRe</i>)⌝ (man)</td></tr>
</table>

**Source:* J.H. Breasted, *Ancient Egyptian Records - Part One*. London: Histories and Mysteries of Man Ltd., p.102.

name of each priest, organised by month and season; and, (iii) the amount of land held by each priest. The table also contains some reference to rations to be paid, in the form of meat, bread and beer. The endowment was made by king Userkaf, the first Pharaoh of the Fifth Dynasty, to the temple of the local Hathor of Royenet, to be administered, along with another tomb endowment not examined here (see Breasted, ibid:103–107), by the temple priesthood. Nekonekh, to whom the endowment of Pharaoh Userkaf was made, was a steward of the palace and priest of Hathor at Tehneh. He allocated the endowment between his 13 children as priests of Hathor (whose names are listed in the left hand column of Table 1); one month each to 11 children with the twelfth month shared by the other two. The 60 stat (*aroura*) of land were allocated so that 11 children were to receive each the income from five stat, with the two remaining children sharing the income of five stat.[8]

Another incidence of the context-dependent intervention of accounting relates to the determination and distribution of rations or temple provisions as shown in the fourth entry, Third season in Table 1. Here we encounter very precise quantities of different types of food, as reflected in 'the rations of bread and beer', being allocated to individual members of temple staff. In order to be in a position to determine such rations in the first instance, it is likely that another set of calculations relating to the supply side would have had to be made. For without securing the right amounts of supplies both in terms of their variety (e.g. beer; bread; meat) and quantities (e.g. numbers of loaves of bread) it would not have been possible for the temple scribes to meet demand. Although the above examples focus more upon the demand side, that is the rations that had to be paid daily to temple personnel, the absence of information on the co-ordination of the supply side does not imply that such co-ordination did not take place. As shown below, the matching of supply and demand is an intricate exercise of fine accounting and administrative skills. What cannot be said, however, is whether demand drove supply or whether supply determined levels of rations for temple personnel. To the extent that the rations per person corresponded to a widely used universal metric, then we may assume that the demand for temple provisions determined supply. But in periods of economic crises, it is likely that levels of supply available determined levels of provisions (see Ezzamel, 2002c).

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[8] Although in the Table 5 stat are listed 13 times, the 5 stat entered against 'Left vacant (disappeared)' is an error by the scribe as shown when Figure 1 is compared against the other figures relating to the same endowment. Hence, the total endowment is 60 stat and not 65 stat (see Breasted, 1906/1988, Part one: 102, footnote c).

These early examples of accounting for temple activities demonstrate just how contextually embedded accounting practices were. From a contemporary, economically-motivated perspective, funerary and temple activities could be seen to have been stripped down to basic rational elements through the intervention of accounting, so that the domain of the spiritual became subjected to the calculus of profane accounting and administrative practices. Apart from performing their religious duties, priests might be seen to have acted as economic agents managing specific accounting-based allocations of the funerary endowments on behalf, and subject to the instructions, of the owner. From this perspective, accounting would be located at the heart of the allocative practices employed in the temples and funerary cults in the Old Kingdom, determining precisely how much of the land would be allocated to each priest, and for what length of time. Punitive measures were developed which stipulated how penalties were to be exercised whenever a priest was found to have breached the contract with the dead owner. Accounting would therefore be conceptualised as a technology that brought the living and the dead into a unity forged through a set of economic rights and obligations. In this way, economic relations would be seen to be brought to the forefront, even among the priests, through the intervention of accounting, with each priest being incited to be vigilant by watching over the actions of other priests and reporting on those who do not observe strictly the clauses of the contract. To the extent that priestly training, socialisation and spiritual aspirations could have militated against opportunistic behaviour, under the above perspective this would not have been considered sufficient when dealing with the management of temple endowments. In contemporary terminology, the intervention of accounting could be seen to have brought a more precise and worldly dimension to the responsibility of the priests over managing temple endowments. Even under this perspective, the intervention of accounting into the domain of the sacred is not seen as being necessarily unwanted, 'irrelevant', 'highly rudimentary', or an inconvenience without which 'the sacred work could continue unhindered and untroubled' as Laughlin (1988:33) claims for the case of the Church of England. More importantly, as I will argue later, this economically-driven view may have been antithetical to the ancient Egyptian way of life. It will also be argued that accounting is a mediating technology that can link the supernatural and material worlds into one unity, a view that economically-driven explanations are unlikely to accommodate.

4. Accounting and the Abusir Papyri

The site where the Abusir Papyri were excavated[9] was the funerary temple of king Néferirkarê-Kakai (henceforth Néferirkarê), Fifth Dynasty. The papyri contain records of temple activities during the reign of several kings from Néferirkarê onwards, for a period of approximately 200 years. In contrast to the stone inscriptions analysed earlier, the Abusir Papyri 'are at the moment the most ancient published papyri as the vast majority of preserved fragments belong to the reign of Isesi (around 2390 BC) and the most recent is contemporary with the reign of Pepi II (around 2250 BC)' (Posener-Kriéger, 1979:133).[10]

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[9] The Abusir Papyri, published by Posener-Kriéger and Cenival (1968) and translated by Posener-Kriéger (1976), were found in two bundles; one in 1893 by clandestine excavators at Abusir and the other in 1907 by the Deutsche Orientgesellschaft (the German Oriental Centre) under the direction of Borchardt. More discoveries of monuments and papyri have since been made at the same site by the Czechoslovak Institute of Egyptology under the direction of Mirsolav Verner, but these are yet to be published (Posener-Kriéger, 1997:17). Dr Stephen Quirke has indicated to me in a private communication that the significant contributions of Verner's discoveries relate to chronology rather than to accounting and administrative practices.

[10] The only surviving papyri found that could have possibly predated the Abusir Papyri, by between 80 and 100 years, are those of Gebelein, but they have not been published yet (Posener-Kriéger, 1976: xi) and their dating is still debated by Egyptologists.

The reign of Néferirkarê, third in line to his brothers Userkaf and Sahure, is poorly documented but is thought to have lasted about 10 years.[11] He ascended the throne in middle age, and his funerary complex was completed after his death by his successors Neferefre and Niouserre. The temple complex (see Posener-Kriéger, 1976:493–533) consisted of three main parts: the funerary temple of Néferirkarê; the solar temple of Re, and the royal temple of the Queen Mother.[12] The Abusir Papyri reveal that large supplies of foodstuffs were consumed daily by various personnel in the funerary complex; for every day, it had a revenue of 22 fowl and one large cattle (cow).[13]

By meticulously piecing together the various fragments of the Abusir Papyri, Posener-Kriéger and Cenival were able to re-assemble no less than 104 plates of inscriptions which they classified into six different categories: duty tables; inventory lists; accounts; personnel lists; records of temple inspection; and letters. Of these, the last two categories do not contain accounting entries, and the personnel lists had some accounting entries but their details are missing. Hence, the following discussion focuses on the first three categories.

4.1. Duty tables

Duty tables differed along three dimensions: format, frequency and content. Concerning their format, they were either inscribed in aggregate, summary terms or were arranged as compartments of a grid detailing the duties to be performed by members of each phyle while on duty. The grid format was used in the case of the detailed entries. Both forms were complementary, for the summary tables appear to be an aggregate of the tasks that were inscribed in greater detail later. As to their frequency, duty tables were either prepared for every month of the year on a daily basis, or compiled for special occasions such as feasts. In terms of content, each table consisted of columns containing the following: the year, the reign of the relevant king, the subject matter of the table, the date of duty, a listing of the tasks to be performed, and titles and names of staff on duty (Posener-Kriéger, 1976:8). The tasks listed can be classified into four categories (Posener-Kriéger, 1976:15–57): (a) the cult of the dead king (e.g., oils, offering table, tomb purification); (b) the exterior and interior guarding and policing of the temple; (c) transportation (divine offerings, meat and vegetables); and (d) royal statues. Several scribes, with their title designations, were also listed (ibid:109). All entries related to the organisation and control of labour activities. Hardly any of the duty tables in the Abusir papyri has survived intact. The tables include one example enlisting supplies, for the Night of Re festival, of drinks brought from the solar temple of Re, St-ib-R' (Set-ib-Re) and materials from the Residence, but the numbers are missing (ibid:116–117).

4.2. Inventory lists

Inventory lists were kept either in detail or as summaries, recording materials and objects differentiated by name (see Posener-Kriéger, 1976:162–187). The materials inventoried included silver, gold, precious minerals and hard stone, crude/rough stone, red meteoric iron, flint, quartz, incense, various wooden objects and acacia wood, copper, lapis-lazuli, fabrics, and oils. The objects inventoried ranged in name to include goblets, bowls, plates, offering tables, blades, knives, vases, pellets, chests/trunks, altars, batons, mortar, pearl strings, necklaces, needles, incense, bottles, oils, and divine boats. The accounting entries made it possible to trace clearly every individual item or object.

As can be seen from Table 2, the scribe used the grid, or cross-lined, pattern to organise the tabular format of the inventory list.[14] This grid pattern shows the 'tidy minds' (Kemp, 1989:112) of the scribes at work. Rather than provide a simple list of the inventory items in a haphazard way, the scribes used a flexible three-tier classification scheme that made it possible, at a glance, to check the status of each item:

- The first tier signalled very general headings: crystalline stone, flint, and iron.
- The second tier provided a more refined designation of items, for example crystalline stones were divided by type into bowls and vases. At this second tier level a new item is listed as offering tables, which for some reason was not classified under a broader heading. Hence, the scribes maintained an element of flexibility in utilising the classification scheme rather than being rigidly restricted by its coding scheme.
- The third tier provided for an even finer level of detail, so crystalline bowls and vases were each classified by colour into either black or white. Similarly, offering tables were classified further by size into either small or large. Also, the scribes entered silver items as a new category.

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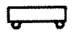
[11] See Posener-Kriéger (1979:136), but Gardiner (1964: 435) assigns 20 years to his reign.

[12] The funerary temple had an entrance hall, vestibule, court, chapel, several halls for such things as offerings and treasury, terrace, granaries, and various annexes. While I have no information about its precise dimensions, measures of the main parts of the funerary temple indicated by Posener-Kriéger suggest that it was approximately 80 meters long by 50 meters wide.

[13] Posener-Kriéger (1979: 148) estimates that one cow could feed 1,000 people. Even if this is an over-estimation, there is little doubt that funerary temples, such as that of Néferirkarê, supported a large number of dependants.

[14] The original of this inventory list (Posener-Kriéger and Cenival, 1968: plate XX) contains 16 columns but they are not all reproduced here because of damage to the plate.

Table 2
Inventory list: the Abusir Papyri*

haematite	crystalline stone				flint	iron			
bowl: gold-plated	bowls		vases		ritual knife	blade	total of	offering-tables	
	black	white	black	white				small	large
							silver items		
1	2	1	1	1	1	2	23	2	1
	(?)	various repairs to rim & base (x2) (x2) & to sides	repairs to rim & base	repairs to sides; holed (x2)	handle chipped; repaired	splinters missing, having been dropped		badly split; loose joints; corroded	badly split; loose joints; corroded
1	2	1	1	1	1	2	23	2	1
	(?)	ditto	ditto	ditto	handle & blade chipped	ditto		ditto	ditto
1	2	1	1	1	1	2	23	2	1
	ditto	ditto	ditto	ditto	ditto	ditto		ditto	ditto
	(?)	ditto	ditto	ditto	ditto	ditto		badly split; loose joints; holed	badly split; loose joints; holed
1	2	1	1	1	1	2	23	2	1
		(repairs) ditto	ditto	(chipped) ditto	ditto	ditto		ditto	ditto
1	2	1	1	1	1	2	23	2	1

**Source:* B.J. Kemp, *Ancient Egypt: Anatomy of a Civilization*, London: Routledge, p118.

In the appropriate space within this grid the scribes made entries of the items or objects which required recording. This type of inventory list was reserved for recording all items that had been damaged while in the custody of the departing phyle and before the incoming phyle arrived. Responsibility for damaged items was therefore allocated to the appropriate phyle in service when the damage occurred. As Table 2 demonstrates, not only did the scribes list the number and type of damaged items, they also provided a description of the precise damage or repair required. Thus, the black vase in the first entry required repairs to rim and base, whereas the splinters of the iron blade were missing, having been dropped. The small and large offering tables were badly split with loose joints and corrosion. In contrast, the silver objects, while not being precisely defined or itemised, were repeatedly recorded as total numbers (23 items/units).

In the original version of the hieroglyphic, the combination of red and black inks were used to good effect both in drawing the lines of the grid and in the actual enumeration of items and description of their status. Red and black lines were used both horizontally and vertically to define the cells in the grid. Moreover, although the designation of categories in the classification scheme was made mainly in black, entries on the first line listing numbers of items and the descriptions of their condition in the cells immediately below were made in red. Thereafter, the description of the condition of each item continued to be in red, whereas the numbers were inscribed in black. This contrast between descriptions in red and numbers, with the exception of the first line, in black highlighted the visibility of numbers against narrative, and the use of red and black lines enhanced the visibility of the cells.

The grid structure of the inventory lists contained double cells (or spaces) immediately below the listing of the numbers of items of a particular category. The first cell is much larger than the second, and it is in the first that the scribes recorded the description of the damage to items and the repairs required. On occasion, the description continued into the second cell, as in the case of the white crystalline bowl in the first entry. The remainder of this second type of cell is blank, and this has given rise to some uncertainty regarding the precise purpose of this space. Kemp (1989:113) states that this 'reflects some kind of double-entry procedure which is not properly understood, for the space of each set of inscriptions is itself subdivided by double lines ruled in red to accommodate two sets of observations if necessary.'[15]

The structure and organisation of inventory tables is very consistent throughout (see Posener-Kriéger, 1976:125–127). Once items were entered onto the inventory lists, identified in number and described in detail, inspection ensued thereafter. In the case of the single-line lists an inspection was followed by a red line before listing the numbers of the items inspected which was followed by a black line, and so the cycle of inspection and listing continued. In the case of the double-line lists, an inspection was followed by a black line, then by listing of numbers of items followed by a black line, then another inspection was recorded followed by double red lines, before another round of inspection took place. Hence, whether a single or double type of inventory list was used, repeated inspection of the inventoried items were made, and in each case the inspection was followed by entries stating the condition and number of the items inspected.

Posener-Kriéger (ibid:127–128) offers two possible explanations of the purpose of the double-line inventory lists. Either each list was used as a way of verifying the inventory items by recording them as they left the temple and upon their return to the temple, or the list was made by two different inspectors upon their return, with the second entry corroborating the first. She then surmises that the second interpretation is the more likely, because damaged items observed for the first time were nearly always entered on the first, but not the second, line of inspection. On occasion, when the first inspector failed to notice and record a damaged item, this was noted and recorded on the second line by the second inspector. Posener-Kriéger (ibid:128) argues that the second interpretation 'is corroborated by the existence, in the single-line list, of oblique lines next to the figures: these lines could have been drawn by the second inspector.' It seems that the description of the condition of the damaged items of inventory registered on the first line was the report of an earlier inventory made by the first inspector. Although the different successive lines of inspection correspond to the rotation of the phyles on duty in the temple and could therefore be suggestive of a link between the inventoried material and phyle rotation, this potential link remains tenuous (see also Posener-Kriéger, ibid:128–129).

4.3. Daily and monthly temple income accounts

The daily and monthly income accounts are a large part of the Abusir Papyri and cover a variety of types, including 10-day (weekly) journals, monthly revenue accounts, accounts of fabrics, meat, fowl, grain, distribution of food provisions to temple personnel, transfer of offerings, seasonal accounts, and accounts of deliveries during festivals. Given the regularity and neatness of the daily accounts, it is thought that they were copied from notes (Posener-Kriéger and Cenival, 1986:xiv). Before any detailed examples are discussed, I provide a brief summary of the types of items entered in most accounts in order for their level of detail and complexity to be appreciated (Posener-Kriéger, 1976:231–339). Seven broad categories of items recorded can be distinguished, with several individual items within each category. The broad categories include bread and cakes; liquids/drinks; meat; fowl; animals; cereal; and other products (mainly oils and fat). Adding all the finer types classified under the seven categories produces a total of 64 items. For the majority of items, pure enumeration was used by counting identities: e.g., numbers of loaves of bread, jugs of beer, heads of livestock. Cereals and grain were recorded using a capacity measure, the *khar* (= 76.88 litres; see Janssen, 1975b:109).

In the monthly accounts the grid pattern was used, with the cells, the numbers entered and the relevant descriptions made in a combination of black and red ink; see Table 3.

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[15] When Kemp mentions 'double-entry' he means 'double-description' of the items listed.

The original account is divided into 36 horizontal lines and 21 vertical columns (see Posener-Kriéger and Cenival, 1968, plates XXXIV and XXXIVA). Horizontally, lines 1–6 contain the headings of the account while lines 7–36 are one line for each of the 30 days of the month to which the recording of temple income relates. The 30 days of the month were divided into three 10-day weeks (10 black lines) separated from each other by a red line. Vertically, the date of each entry was noted, followed by entries of the relevant activity. Each of the sections relating to temple revenues invariably has three columns, one recording in red the quantities to be received, the second recording in black the actual quantities received, and the third showing in red the balance outstanding. These examples together show how the ancient scribes made judicious use of different colour inks to visualise more clearly important sections, entries, categories or numerals.[16] As in Table 2, red ink was reserved for numbers to account for and balance remaining, whereas black ink was used to record actual quantities/amounts received or delivered. The grid also shows the sources of each type of delivery (kinds of bread, beer, good things, etc.) and the names of the persons or porters responsible for its transport.

Further, the account also shows, for every day of the month, the precise quantity of every type of good (e.g. specific kinds of bread) delivered to the residence. For example, the amounts recorded in red of 14 units of *pat*-bread due per day for the first five days of the month from the palace were also recorded in black as actual deliveries (70 units) on day 5. In contrast, the amounts recorded in red of the same type of bread as due for the next six days (days 6–11) were not received in the solar temple of Re during the month, and hence were entered daily in red as balance outstanding. In total, of the deliveries due of this type of bread for the whole month, only the deliveries of 19 days were received, leaving as remainder the dues for 11 full days! The same pattern is repeated for other items such as 'good things' and the bread and beer brought from the palace. None of the four deliveries of the 'good things' due was actually made, and only the bread and beer dues of seven days were delivered leaving the dues of 23 days as outstanding balance.[17] Nothing is known about how and when these outstanding balances were, if ever, delivered, but we may assume that they were delivered later in bigger bulks, as occurred earlier in the month. Precisely how the administrators of the temple dealt with significant shortages in supplies is not made clear in this account.

The left hand-side of the account details the daily deliveries sent to the residence, their sources, and the names of the porters responsible for their transportation. Three different types of bread are identified, in addition to deliveries of flour, beer, and a particular drink. The grid also shows deliveries of meat, fowl, and mixed, unspecified, items. Presumably because these latter items did not occur sufficiently frequently, the scribes did not designate special headings for them at the top of the account as in the case of the more frequent items.

Various units of measures were used in the accounts. In the case of drink, beer and flour, these were measured in jars, presumably of a similar capacity. Meat was quantified in haunches, and bread appears to have been counted in numbers of loaves. No indication is given in the accounts of the fowl delivered, whether they were of the same type and size, or a combination of different types such as ducks, geese, and other birds. If the fowl belonged to different types, no explanation is made in the entries to suggest that the nutritional values were equated across types. When different daily accounts are inspected, it appears that the levels of theoretical revenues due to be delivered vary but without a clear indication as to why these variations occur or who authorised them. As Posener-Kriéger (1976:626) has surmised, since these theoretical figures of revenues were known in advance to the scribes, it is likely that they were subject to modifications to reflect circumstances.

Other accounts detail amounts of different commodities to be delivered to named individuals (also differentiated by rank or function) as rations (ibid:317–319). One of the daily accounts (3rd day, month of *Shomu*, third season) records the distribution of meat, whereby the lector priest and the meat porter each received the same allocation of two measures/units, compared to the *wab* priest who received 20 measures (ibid:322), thereby pointing to the variability of rations according to title, status and nature of tasks undertaken. Another category is the grain accounts, typically measured in *hekat*, which shows grain, amounts to be delivered to the temple, actual deliveries, and balance remaining.

Table 4 details the grain accounts of two types: *Ble* and *Ph3* and, by way of demonstration, I will concentrate only on the former. Of the total amount of 60 *hekat* of *Ble* grain that should have been delivered, only 57.5 *hekat* were delivered, leaving a re-

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[16] The alternative use of red and black ink in the Abusir Papyri has the other welcomed, yet most likely unanticipated, effect of making the inscriptions more intelligible to present day scholars (see Posener-Kriéger and Cenival, 1968: xviii).

[17] Not all of the Abusir accounts exhibit such large disparities between amounts that should have been delivered and actual deliveries; there are many accounts where both quantities are almost exactly equal. One example is table 35B (Posener-Kriéger, ibid:282–283; see also Table 37:280–281) where quantities of different types of bread and drinks to be delivered daily were actually all delivered on time with the exception of two cakes.

Table 3
Monthly income account: the Abusir Papyri*

name											the altar of Ra			in crates		
of the	through deliveries sent to the residence						name of the	brought from the palace			in the solar temple					
porter	jars of *sekhpet*-drink	jars of beer	jars of flour	*beset*-bread	*pesen*-bread	*hetja*-bread	place of origin	*ida*-bread, *padj*-bread, *hetja*-bread, *pesen*-bread, beer			consignments of *pat*-bread			good things		
											balance	delivered	amount due	balance	delivered	amount due
								18		18			14			
temple								18		18			14			
employees		3		1	1		estate of Kakai	18		18			14			
									18	18			14			
	1	1	1	1	1	1	Iu-Shedefwi		18	18		70	14			
									18	18	14		14			
Ni-Ankh-Kakai		3		1	1		estate of Kakai	18		18	14		14			
								18		18	14		14			
Ni-Tawi-Kakai,		3		1	1		estate of Kakai	18		18	14		14			
son of								18		18	14		14	10		10
Hatu		1		1	1	1	Djed-Sneferu		36	18	14		14	10		10
										18		14	14			
								18		18		14	14			
								18		18		14	14			
								18		18		14	14			
		3		1	1		estate of Kakai		36	18		14	14			
										18		14	14			
								18		18		14	14			
								18		18		14	14			
										18		14	14	10		10
										18		14	14	(10)		(10)
										18		14	14			
Ni-Tawi-Kakai	2 haunches of beef		4 fowl		100	(?)	brought from the altar of Ra			18	(14)		14			
										18	(14)		14			
	mixed			mixed						18	(14)		14			
brought by	3	0		3	0		solar temple			18	(14)		14			
boat										18		14	14			
	1	1	1	1	1	1	Iu-Shedefwi			18		14	14			
										18		14	14			
										18	14		14			

*Source: B.J.Kemp, *Ancient Egypt: Anatomy of a Civilization*. London: Routledge, p.118.

Table 4
Grain account (41, c 2)*

Year 21, fourth month of *Akhet*, day 22, Account of grain deliveries of *Ph3* and *Ble*

		Ble		***Ph3***		
Amounts to be received	:	60	*hekat*	60	*hekat*	
Deliveries of replenishments	:	57.5	*hekat*	0		
Nine small livestock	:	2.25	*hekat*	0		29
Assortment of fowl	:	0.75	*hekat*	0		28
Total of expenditure categories	:	3	*hekat*	0		
Real/actual remainder	:	54.5	*hekat*	0		
Deliveries coming to the temple	:	50.5	*hekat*	0		
Arrears	:	4	hekat	0		

**Source:* translated into English from Posener-Kriéger's (1976:329) French translation from hieratic.

mainder of 2.5 *hekat*, which is not recorded as such in the account. Responsibility of the intermediate receiving institution was restricted to the quantity of 57.5 *hekat* that it had actually received. Against this amount, there is a total allowance of 3 *hekat* (2.25 + 0.75) expenditure presumably for feeding livestock and fowl, leaving 54.5 *hekat* listed as the real/actual remainder. Of that quantity 50.5 *hekat* were delivered to the temple, leaving 4 *hekat* in arrears.

Account 50, 1 a and b (Table 5) links up neatly with the above account, showing the expected theoretical delivery of 60 *hekat* combined for the two types of grain; *Ble* and *Ph3*.

Apart from 60 *hekat* of grain expected to be delivered from each source, in the case of *Ph3* there is an allowance for the cost of transporting grain in the small boat across the river of the amounts 1.5 *hekat* plus 1.75 *hekat* (in total 3.25 *hekat*).

These two accounts embody some important attributes from the perspective of human accountability. First, the receiving institution, as a locus of accountability, was held responsible for what it could control. In each case, the institution was charged with the amounts of specific goods it had *actually received*, rather than the amounts it should have received. Second, expenditure allowances (animal feed and transportation cost) were stated unequivocally and netted against actual deliveries before calculating the final amounts for which an institution was held responsible. Third, the balance outstanding (remainder between amounts charged to and received from each institution) signalled the indebtedness of the institution to other institutions or the state.[18] Fourth, each account specified the appropriate dates and places thereby enshrining accountability in precise temporal and spatial designations.

The accounts of the Abusir Papyri were developed in a way that virtually subordinated all manner and style of inscription to the dictates of accounting. This included the use of a noun-dominated, limited technical vocabulary suited to, or possibly developed for, accounting to explain the individual entries. The Abusir Papyri are concise technical documents suited to scribes and administrators. As Posener-Kriéger and Cenival (1968: xiii) argue, 'No explanatory passages or glosses occur in the texts; they were not necessary, for the documents were drawn up for or by the temple attendants who were well acquainted with the circumstances in each case.' Such texts may be considered of little interest to all those able to read, or may be treated, as 'texts of accounting fanatics or ardent admirers of lexicography' (Posener-Kriéger, 1979:134). Yet, at least for some, it is in this seemingly less imaginative style of inscription, and apparently less reader friendly grid format that 'the daily life of the temple is revealed ...scenes of the duties of the temple personnel... all sorts of accounts, the sorts which give us a rich and diverse documentation, ..., whose power of evocation is hardly comparable' (ibid:134). The use of different colour inks, lines in grids, headings and the account numerals themselves made it much easier to differentiate individual entries.[19]

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[18] The scribes' treatment of arrears was not always consistent, as evident, for example, in the failure to record the remainder of 2.5 *hekat* in Table 4. This may suggest that such accounts were intended to safeguard the supplies once they had been delivered, rather than to track rights and obligations, as one reviewer kindly pointed out to me. However, most accounts I have examined have tended to note remaining balances, although it is never made clear what *actions*, if any, were taken to restore these balances. See also footnote 17, which indicates that in many of the accounts in the Abusir Papyri hardly any discrepancies were noted between expected and actual deliveries, which is likely to have been the result of monitoring rather than pure chance.

[19] Before we credit the Abusir scribes with all these technical developments, it is worth noting that the scribal tradition had already been well established by that time through the educational and training practices developed in the Old Kingdom (see Ezzamel, 1994). Posener-Kriéger (1979: 137) makes a similar, but more specific, point: 'The accounts from Gebelein, organised in exactly the same way as the Abusir documents, show us that the scribes of the Néferirkarê temple had not invented anything, but that we have here an everyday kind of document, which is the fruits of experience in administrative work.'

Table 5
Grain account (50, 1 a&b)*

….. Day 24 (+?)
Receipt of the goods coming from the Residence
Account a
Domain < The house of
Horus *St-ib-t3wj*
(conscript) *gs…>*

					The house of the king		
Amount	Deliveries	Remainder	Small boat	Amount	Deliveries	Remainder	Small boat
Ble 30 *hekat*	30	0	0	30	30	0	0
			Bread				
Ph3 30 *hekat*	28.5	?	1.5	30	28.25	0	1.75

Account b
Were placed in 20 recipients of Sed
taken to the granary
of *St-ib-R'*

	The last day of the month	The first day	The third	The ninth
Ble	4 *hekat*	6 *hekat*	10 *hekat*	10 *hekat*

**Source:* translated into English from Posener-Kriéger's (1976: 332) French translation from hieratic.

5. Discussion: temple supply and redistribution

'[T]he Abusir Papyri … reveal the major role of the residence in the economy of the Country and underscore the excellence of an active and effective administration which, thanks to competent scribes and conscientious accountants, made possible the greatness of the Ancient Empire.' (Posener-Kriéger, 1979:150, translated from French).

In the previous section, I examined in some detail the key accounting documents in the Abusir Papyri. The aim of this section is to explore the implications of these accounts and to shed further light on the cycle of temple supply and redistribution revealed by them. I analyse the scope and significance of the intervention of accounting practices in the activities of funerary temples, and comment on the extent to which accounting underpinned the view of the temple as the locus of interaction between what might be viewed as the sacred and the profane. Typically, pious foundations were established to furnish the temple with supplies. As Kemp (ibid:112) has observed '[t]he receipt of income and distribution of rations set in motion its own little administrative cycle. Although the income could be supplied by the palace of the living king, a measure of security was obtained by establishing a pious foundation in perpetuity. This consisted essentially of agricultural estates, the income of which was directed to the support of the staff maintaining cult and fabric at the pyramids.'

5.1. Implications of the lists and accounts

The duty tables and inventory lists were distinguished by two characteristics: economy/ clarity of text (*organisational visibility*) and precision of information content (*technical visibility*). The visual organisation of the text, using the grid format and a combination of black and red ink, made it easy to trace a particular entry or to focus upon a specific task, individual or item. The precise location of a particular entry in a specific cell could be located unambiguously by moving across the grid both vertically and horizontally. By recording the precise damage to a particular item in the inventory list using red ink against the black ink background, the damage was made more clearly visible than if only one colour was used throughout the list.

Two sets of techniques underpinned technical visibility. The first was the detailing of the precise nature of tasks to be performed, number of items involved and individuals or phyles responsible. The second was the use of a taxonomy employing a carefully thought out hierarchy according to which items were grouped in a descending manner beginning from the broadest through the intermediate to the finest classification. An individually damaged item could therefore be traced to its precise individuality and to the broader category to which it was allocated. These entries were motivated by the desire to assign clear responsibilities to the departing phyle at the end of its term and to ensure that the incoming phyle begins with a clean sheet. Evidence from later periods suggests that the entries made by the scribes in such inventory lists were complemented by a twin-reporting cycle: one by the departing phyle detailing the inventory it is leaving behind and the other by the incoming phyle indicating the state of inventory it is receiving (see Parkinson, 1991:89). By recording damage details, it was possible to identify and plan repair work required in time before the arrival of the new phyle. The single and double audits conducted for inventory items reveal a keen interest by the scribes to keep tight control over inventory. The twin-reporting cycle by the phyles themselves would have squared the cycle of this ancient system of human accountability.

In the weekly and monthly accounts, these principles of *organisational visibility* and *technical visibility* were also observed, but in addition a chain of *dependency visibility* was emphasised, which is examined in more detail later. The use of red ink to differentiate expected actual deliveries and balances and black ink to record deliveries, combined with the grid format design made it easy for the scribes to identify specific entries and possible shortages in deliveries. The red horizontal lines repeated after every 10 black lines, separated each week from the other, and the black horizontal lines delineated clearly each specific day of the week. The naming of the persons responsible for the deliveries, the sources of each delivery and the institution to which each delivery was sent identified the centres of responsibility at each stage of this supply/distribution cycle. Finally, as the date and place of each entry were recorded, the entries were designated spatially and temporally. A form of ancient time-space zoning was, therefore, embodied in these accounts.

5.2. The cycle of temple supply and redistribution

What do the daily and monthly temple income accounts in the Abusir Papyri reveal about the economic cycle of supply and redistribution and the daily activities in the funerary temple of Néferirkarê? I have attempted to piece together this complex supply and redistribution chain in Figure 1 below, which I will use as a guide for the remainder of this section.

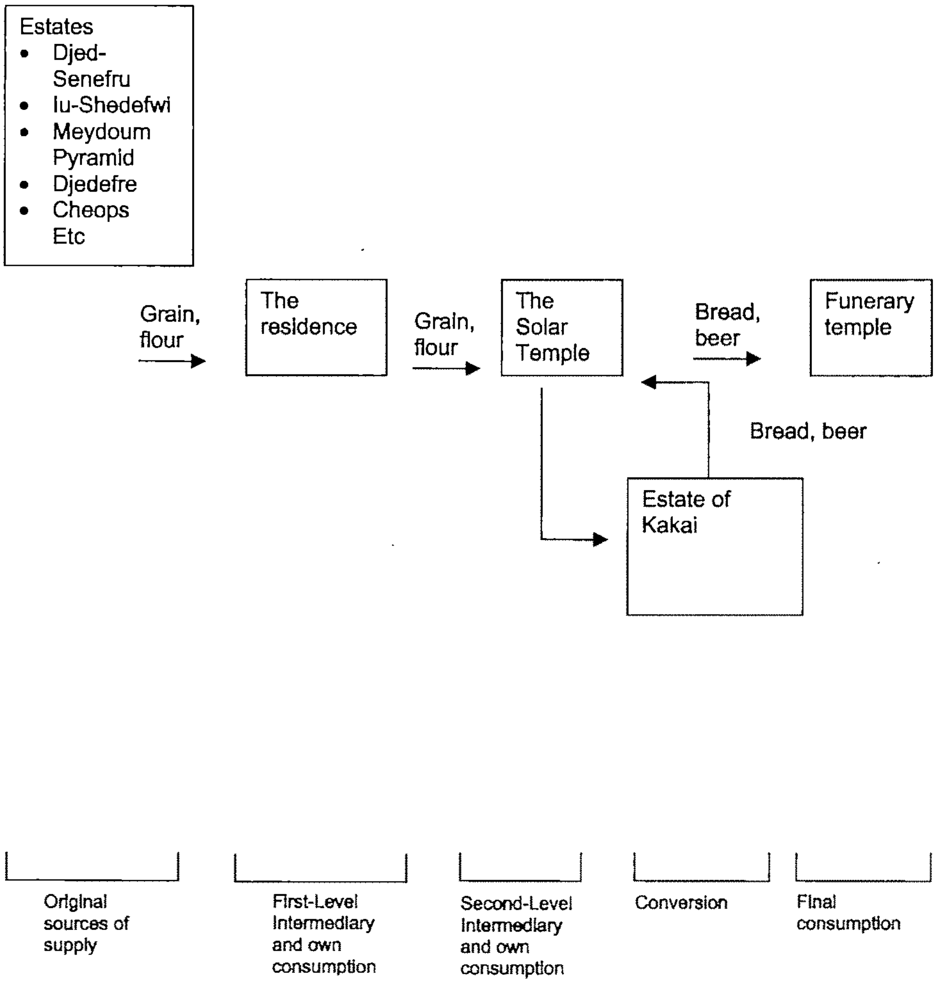
Reading from left to right, Figure 1 shows a reconstruction of the grain redistributive system carried out in mortuary cults. The top of the Figure shows the various units involved in the redistributive cycle, and the bottom part classifies these units in terms of original sources of supply, intermediary units, conversion of input into output, and final consumption. Supplies from different sources (e.g. different estates) were sent to the residence. The scribes at the residence recorded these incoming revenues and differentiated them by source. The residence kept whatever quantities were allocated to the palace and its dependencies. It also sent to the solar temple the provisions allocated to the funerary cult (for both the solar and funerary temples) in raw form (grain). Upon receipt of the grain provisions the solar temple recorded their quantities differentiated by source of supply and passed them on to the estate of Kaki which converted them into the requisite quantities and types of breads and beers and sent the finished products back to the solar temple. The solar temple kept its own provisions and sent the allocations of bread and beer due to the funerary temple. Given the recording of the original sources of supply, the scribes were able to credit a given source with the right quantities of bread and beer. In addition, deliveries of fowl, meat and fabric were sent from the residence to the temples which were then consumed on the temple premises in accordance with the authorised quantities. This reconstruction, however, is not straightforward, and the subsequent analysis shows how I arrived at it.

There are at least two pertinent observations relevant to the above re-construction (see also Posener-Kriéger, 1979:139). First, the funerary temple received supplies on a daily basis, implying not only that foodstuffs were fresh for immediate consumption, but also that the temple was totally dependent upon external supplies for survival. The funerary temple itself possessed very little, if anything, of the foodstuffs required for maintaining its activities. A small boat, navigated by two or three men, was used to bring these fresh supplies daily. Second, the two main sources of regular supply of basic foodstuffs were the solar temple and the palace of one of Néferirkarê's successors to the throne (see Table 3). Surprisingly, the main source of supply that one would have expected to see in such circumstances (the pious foundation based on agricultural estates, see Kemp, 1989:112) is conspicuously absent from the accounts. In noting the same discrepancy, Posener-Kriéger (1979:139) points to the existence of these estates for Néferirkarê:

> 'We know, in fact, that these estates still existed when the majority of the documents that we have were written, because the state tomb employees who were contemporary to the Abusir Papyri counted these estates among the provision sources for their own offering tables. We also know from a more indirect source in the form of the names of the staff of the funerary temple some of whom carried the names of Néferirkarê's known estates, ... [that these estates] were dedicated to the maintenance of the royal cult. Yet, none of these documents appear in the Abusir Papyri as a direct or indirect source of the supplies used in the temple.' (Translated from French)

These observations raise questions concerning the economic status of two sources of supply for

Figure 1
The pattern of temple redistribution in the Abusir Papyri



Néferirkaré's funerary temple: the solar temple and the palace of his successor. Solar temples were built by Néferirkarê's predecessors, but their precise role eluded Egyptologists until a few decades ago. Posener-Kriéger (1979:140) refers to the work of Erich Winter who showed that solar temples were not holy temples dedicated to the cult of Re (the all important Sun-God), for if this were the case then we would not have found different solar temples for different Pharaohs but rather a main solar temple developed and expanded further by subsequent Pharaohs. Winter claims that these solar temples were linked to the funerary cults of the deceased Pharaohs. Posener-Kriéger (ibid:140) argues that the Abusir Papyri decisively support Winter's views:

> '...because they show that the funerary temple and the solar temple form an inseparable ensemble and that, of the two royal sanctuaries, it was not the funerary temple which was the most important, but rather the solar temple because, economically at least, the first only constituted an annex of the second, however it was a necessary and even an essential annex, since it was in the pyramid that the body of the deceased king was buried.' (Translated from French)

Hence, the solar temple was a crucial economic entity aimed at provisioning the funerary temple. What does this say then of the nature of activities undertaken in the solar temple of Re? The accounting entries in the Abusir Papyri show that the solar temple was not a production unit but a conduit for the receipt and distribution of foodstuffs. The sources of these foodstuffs that were brought to the solar temple and recorded in many of the accounts point to another unit upon which the solar system depended; that of the 'estate of Kakai' (*R3-s-K3ki*). This unit was not an agricultural estate; rather, it seems most likely that it worked as a conversion unit making foodstuffs (see Posener-

Kriéger, 1979: 142), for example converting flour and grain into bread and beer. The 'estate of Kakai' then supplied the solar temple and the latter, in turn, supplied the funerary temple.

The residence was another source of supply for the funerary temple. The manner in which the residence and the palace are mentioned in the accounts suggests that they were probably two different, but closely linked, entities belonging to the royal domain of the ruling Pharaoh. It seems likely (Posener-Kriéger, 1976:620) that the palace was not merely a royal residence, but also had various government offices, workshops and storerooms. The residence controlled large quantities of the foodstuffs and in difficult years it was able to regulate the consumption of the temple with the supplies of the Treasury. As evident from the account in Table 3, the deliveries sent from the residence or the palace to the funerary temple of Néferirkarê were rather modest, amounting to a few jars of beer or drink and a few loaves of bread. Moreover, the same account shows that the residence drew its supplies from the estate of Kakai at the rate of four deliveries per month, the estate of Iu-Shedefwi and the solar temple of Re each twice per month, and the estate of Djed-Sneferu once per month. Other accounts show small deliveries coming from the Meydoum Pyramid and the estate of Cheops. However, the estate of Iu-Shedefwi and the Meydoum Pyramid were situated in Upper Egypt, a long way from the location of the funerary temple of Néferirkaré in Lower Egypt.

It is quite inconceivable that such small quantities of fresh bread and beer could have been sent all that considerable distance from Upper Egypt to Lower Egypt. There are two possible explanations. First, Posener-Kriéger (1979:143) argues: '[w]ithout doubt, the load was one of grain; the bread and beer were made from the grain delivered to the residence and, when the supplies reached their final destination, the scribes could register them accurately as bread of a given type and quantity, from the residence, originating from a given place.' Precisely where the grain coming from the Meydoum pyramid and the estate of Iu-Shedefwi was converted into bread and beer is not clear, but it is possible that this took place in the estate of Kakai. This interpretation reinforces the close relationship that linked all these different economic and administrative units: the supplying estates, the estate of Kakai, the residence/palace, the solar temple, and the funerary temple. Indeed, Posener-Kriéger (ibid:146:634–644) suggests that it is unlikely that even the residence, or palace, made its deliveries in the form of bread and beer but rather in the form of flour which was transformed into bread and beer most probably in the estate of Kakai. This argument is particularly appealing in the case of ancient Egyptian beer which did not keep well for long periods of time, and a similarly strong argument applies to fresh vegetables, fish and meat. Various accounts in the Abusir Papyri show that the residence did not only become involved in regular supplies, but also made special deliveries for festivals. When shortages in regular supplies were encountered, further supplies were ordered.

An alternative explanation[20] is that entries relating to distant estates and entities were purely balancing entries rather than reflecting actual deliveries of goods to the funerary temple. This implies that the funerary temple and the various estates and entities were inter-linked via a cycle of debits and credits. Instead of the goods being sent all the way from these institutions to the distant funerary temple, they could have been exchanged between those in close geographical proximity with the temple scribes merely using accounting entries to record these distant exchanges in terms of their effect on the funerary temple.

We can never be certain that either explanation describes faithfully what actually went on. Nevertheless, two important implications emerge. First, a chain-like organisation of supply and distribution units developed suggesting that although the administrators differentiated temple units in terms of production, distribution, and consumption, they linked them inextricably through a chain of dependency relationships that was managed and monitored through the use of detailed accounts. Second, it seems that the accounting entries dealing with distant deliveries reflected a level of genuine and original thinking by the scribes, where the entries did not necessarily match the precise physical goods they were purported to record. These goods may have never moved from one place to another, and if they did, they may not have moved in the precise physical condition described by the accounting entries. Even if this interpretation is only partly correct, we are here confronting the possibility that the ancient scribes were able to think of accounting as something that goes beyond the simple, mirror-image reflection of a concrete reality. The seeds of some abstract thinking that sees accounting as something that constructs a reality rather than the reality 'out there' may have already been sown then.

The details of the entries in the daily accounts also give rise to another question: how were the supplies coming from such diverse sources organised from an administrative and accounting perspective? If the residence/palace had to provide supplies to many funerary/solar temples, such as those of Néferirkarê, throughout the country on a daily basis, this would have created serious logistic and administrative difficulties. The summary monthly accounts, however, provide a clue as to how this was organised. These accounts indicate that the total monthly deliveries were issued from the residence, and that the solar temple received the amounts of provisions needed for its own staff as well as the supplies required by the funerary temple, with each individual delivery carrying labels stating its precise source. Large storage sites, which were located at the residence rather than at the solar temples, were organised in such a way that supplies of the same type were differentiated by source. Deliveries from the residence to the solar temple would therefore have been made in grain or flour, rather than in the form of bread or beer. Thus, even when the supplies of the same type of provisions were transported in one stage and from the same place, the scribes differentiated them by original source in order to avoid confusion when recording the revenues received.

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[20] I am most grateful to both Stephen Quirke and Anthony Spalinger for suggesting this to me.

Hence, the residence played a major role in supporting and co-ordinating the economic fabric of the funerary temple. Further, an intricate web of relationships linked together suppliers, intermediaries, and ultimate consumers. The precarious balancing of supply and consumption was the responsibility of the key co-ordinating conduits, such as the residence and the solar temple, supported by competent and diligent scribes. This *dependency* relationship, as *visualised* through accounting, is shown in Figure 1.

This re-construction suggests a web of economic interdependence in which a significant measure of economic integration was present. Numerous calculations and entries were made virtually at every stage by the scribes, hence the intervention of accounting underpinned the functioning of this administrative system and the various institutions involved in the supply-consumption chain. Accountability could thus be traced from the final consuming unit (e.g. the funerary temple) right through the final administrative conduit (the solar temple), the transport staff (the porters), and the first administrative conduit (the residence) to the original source (e.g. the individual estates). Yet, notwithstanding this detailed chain of accountability, one important link is missing, that of controlling the productive activities of the estate of Kakai. The surviving accounts show no evidence of control over that conversion process. The absence of such evidence leaves open the question of whether or not conversion activities were accounted for.

These arguments concerning the three types of visibility; organisational, technical and interdependence point to a major role played by accounting practices in funerary temples. It is quite difficult to imagine how the various functions of the temple, in their diversity and complexity, could have been performed without this major intervention by accounting. This intervention was not simply at the rudimentary level of house-keeping, but went much further in monitoring and questioning what went on in the temples. Accounting practices were at the centre of the activities of the temple. Rather than accounting being viewed as a profane, unwanted activity that hindered and troubled sacred work, as Laughlin (1988) has suggested in the case of the Church of England, accounting practices in the funerary temples of ancient Egypt underpinned these sacred activities. For by deploying accounting to ensure that all activities were carefully accounted for and monitored and temple demands balanced against its supplies could the priests attend to their sacred religious activities without being burdened by other temple concerns. Accounting practices were instrumental in the construction of the redistributive cycle in every temple, bonding religious and administrative entities together into one social, economic and religious unity as the redistributive cycle had strong religious significance (Goedicke, 1979). Accounting brought both the sacred and profane into a close symbiosis, bridging that presumed abyss between the two that writers such as Durkheim (1976) and Eliade (1959) have strived to maintain.

6. Conclusions

In analysing accounts drawn from remote historical eras, such as those examined in this paper, concern is inevitably raised over their meaning as well as their economic and social significance. First, it is well known that only a small fraction of inscriptions recorded on papyri from ancient Egypt has survived to the present day, hence only a partial view of that society can be re-constructed from surviving records. Second, most of the few records that have survived are damaged, rendering a full reading of all their contents extremely difficult. Third, there is the problem of translating ancient texts into contemporary languages with all the uncertainty over meanings that this entails (see also Ezzamel, 2002a). Fourth, contextual details are frequently absent, for example the reasons for keeping certain accounts or lists. In many respects, such ancient accounts may be noted more for what they fail to reveal than for what they disclose. Yet, despite all these provisos, the rich details of these accounts are tantalising. We are still able to write histories (rather than *the history*) of economic and social life in specific eras of ancient Egyptian civilisation. In a similar vein, the material examined in this paper leads to some important conclusions.

Once an administrative machinery, such as that of the Old Kingdom, is in place, it is likely to extend its purview across the economic, social and spiritual domains:

> 'A developed bureaucratic system reveals and actively promotes a specific human trait: a deep satisfaction in devising routines for measuring, inspecting, checking, and thus as far as possible controlling other people's activities. It draws upon a particular aptitude, as distinctive and important for a society as the genius of its artisans and architects, or the bravura of military men. We call a member of this class a "scribe"...Where most are illiterate, the writing man [sic] holds the key to the power that administration bestows.' (Kemp, 1989:111)

Kemp's quote has more than one true ring to it. For the preceding analysis points to how the administrative machinery of the Old Kingdom managed to extend its power to the domain of the temple. The scribe, not only as the 'writing man', but more importantly as the 'calculating self', held the key to the power that this administrative machinery bestowed. A new set of administrative and accounting practices were articulated upon the space of the temple, its providers, mainly in the forms of different estates, and its benefactors. In a world where accounting is absent, the relationship between the temple, its suppliers and its benefactors may be a simple, straightforward give and take, or provide and make available, on a less-calculating basis. To the extent that the funerary temple in ancient Egypt had an important economic dimension, the intervention of accounting and administrative practices could be seen in the above quote to have constituted the temple into an economic institution and the priests into economic agents. It could be argued that the domain of the temple, including its priests and other personnel, was invaded by the scribes and administrators seemingly to fulfil their satisfaction 'in devising routines for measuring, inspecting, checking, and thus as far as possible controlling other people's activities'. Such a view, however, privileges the profane, economically-motivated role of accounting at the expense of the sacred and spiritual.

One could see just why such a seemingly profane role for accounting is privileged. The evidence from the Abusir Papyri, and from those earlier sources beginning with the Third Dynasty, testifies to the interventionist power of accounting and administrative practices. This evidence could be interpreted to suggest that a whole new scheme was developed whereby administrative units were created and linked closely to existing economic and religious entities via a network of interdependence to secure the careful planning of temple activities and the matching of supply and demand. Work in the temples, in terms of rebuilding, expansion, repair and maintenance, and protection by day and night, was planned and allocated to specific individuals or groups (phyles). Temple assets, whether of a permanent or a perishable type, were recorded in inventory lists, detailing the nature of damage to every item, using a taxonomy which incorporated a hierarchy of different classifications. Recording items using a combination of black and red ink in a tabular format (*organisational visibility*), and the enumeration of quantities of items using a flexible classification taxonomy (*technical visibility*) made it easy for the scribe to signal damaged items as well as the nature of the damage. Apart from legitimising the role of the scribes, this would have made it possible to both trace responsibility for damage to the appropriate (departing) phyle and to plan the repair of damaged items in time for the arrival of the new phyle.

Concerning provisioning for the funerary temple, a most intricate administrative organisation was developed, fully underpinned by accounting inscriptions. The overall scheme was one in which various estates supplied pre-specified amounts of grain and flour to the residence which recorded them by type and original source, took its own allocation and supplied the remainder to the solar temple. The solar temple sent the grain and flour to a producing estate (the estate of Kakai) which converted them into bread, beer, and other types of drinks, and handed the final products back to the solar temple which took its own provisions and gave the requisite rations to the funerary temple. In this elaborate redistributive system, based on precise rations, the scribes could trace a particular delivery to its exact amount and original source with such *dependency* enshrined into, and rendered *visible* via, accounting entries. Through the use of a grid system and the judicious combination of black and red ink the scribe could differentiate between amounts due as revenue, actual quantities delivered and remaining balance. Accounting could also be seen to have played a key role in determining the precise allocations of provisions for every member of temple staff and recording the delivery of these provisions.

This complex and detailed range of accounting intervention in the activities of the temple neither signals accounting as 'irrelevant', nor 'highly rudimentary', nor an unwanted, profane inconvenience without which 'the sacred work could continue unhindered and untroubled', as Laughlin (1988:33) argues to have been the case in the Church of England. Other researchers have already critiqued the demarcation of the sacred and profane domains in contemporary societies (Lightbody, 2001; Hardy and Billis, [in press]; Jacobs and Walker, 2004), and the findings of this paper add to these critiques. In the world of ancient Egypt, this demarcation was quite blurred, as the sacred and profane domains were intertwined. Redistribution of offerings was not seen as a purely economic activity, but had strong religious and sacred elements to it (Goedicke, 1979). The temples were simultaneously the sites of important religious and economic activities, not only heavily involved in worship but also in redistribution. Accounting was therefore at the centre of this redistribution chain, institutionally bonding religious entities (the funerary and solar temples) with administrative entities (suppliers, the residence, and the producing estates) into one economic and spiritual unity. Accounting practices were central in rendering visible, and hence amenable to human intervention, many practices that would otherwise have remained less visible, or indeed invisible (Morgan and Willmott, 1993).

The implications of the findings of this paper can be extended beyond religious institutions such as the temple. The various roles played by accounting practices in matching supply and demand and monitoring inventories in the case of the temple can be mirrored by accounting practices aimed at managing household economy and securing the sustenance of its members. Regular quantification of, and reporting on, human activities in the temple could be paralleled by the capacity of accounting to facilitate monitoring at a distance whereby the head of the household can control his affairs while away from home (Ezzamel, 2002c). Equally, accounting entries can convey a particular esteem or prestige in which certain individuals could be held, whether in remote times such as the Pharaoh Néferirkarê, or in much later historical episodes, such as members of Victorian households (Walker, 1998).

Accounting practices were also implicated in reality re-presentation and reconstruction. Whether the goods recorded as having travelled from the South of Egypt to the funerary temple in the North were actually exchanged in other forms (e.g. grain instead of bread) or only changed hands between entities in the South, a break-through understanding of accounting practices as something that can be abstracted away from actual activities seems to have already been appreciated. Also, accounting intervention could be interpreted to have constructed the priests into agents of the dead; priests were not only expected to honour the contractual arrangements governing their management of temple endowment, but were also enticed to take actions against fellow priests found guilty of opportunistic behaviour. In an earlier study (Ezzamel, 2002b), I provided evidence from the Middle Kingdom, ancient Egypt on the role of accounting in redistributive activities relating to temple staff, as revealed in 10 contracts intended to be executed after the death of a high ranking official. I pointed out how accounting practices underpinned the contractual arrangements of the dead that were finalised in their life times. Rather than being enforced by law, these contracts were sanctioned by social norms as well as incentives built into the contracts to incentivise the priests entrusted with the execution of the contracts to ensure that the measured giving on behalf of the dead is observed. These findings show just how possible it is to conceptualise accounting practices as indispensable to the reconstruction and re-presentation of relations where it is difficult, and undesirable, to demarcate the sacred from the profane.

In ancient Egypt, life in 'this world' and life in 'the other world' were seen as parts of the same phenomena merged into a super cosmic order, contra the views of Durkheim (1976) and Eliade (1959). Indeed, some of what has come to be recognised in contemporary society as the mundane and profane matters of writing and accounting, were in the world of the ancient Egyptians considered to be gifts received from the gods.[21] It is perhaps therefore not too far fetched to suggest that for the ancient Egyptians accounting was seen as sacred and divine, and as an important technology that linked inextricably their two 'life' worlds. This interpretation would gain greater credence once the role of accounting in the temple is linked more explicitly to the godly dimension of kingship. Inability to secure regular supplies for, and continuing work in, the funerary complex would have meant failure to preserve the cult of the dead Pharaoh which could not be tolerated. By organising patterns of supply, determining rations and distribution, recording the movement and status of objects, monitoring temple work activities, and assigning responsibilities, accounting practices served to ensure the preservation of the cult of the dead Pharaoh, in the case of the Abusir Papyri for over 200 years. In this sense, the seemingly profane intervention of accounting and administrative practices can be seen as part of a much wider and holistic concept of divinity. More research on the linkages between accounting and religion, drawn from differing socio-political and economic contexts, is likely to contribute to the debate on the extent to which the thesis on the sacred/secular divide is sustainable.

Rather than tease out the significance of accounting practices from a careful examination of social, political and economic contexts, as scholars dealing with the present or recent past are able to do, what I have attempted to do here is more or less the reverse: to tease out a tapestry of life in ancient

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[21] Thoth was the lunar god of record-keeping, accounting and writing whose cult dates back to, at least, Dynasty I (Watterson, 1996:182–188). Thoth, being a lunar god, was depicted wearing a crescent moon on his head, since the moon was considered the natural measurer of time, and hence, in addition to writing, Thoth was regarded as 'the master of chronology and counting' (ibid:184). His female counterpart was the goddess Seshat.

Egypt from accounting inscriptions. That such a tapestry, crude as it may be, can be constructed at all is a testimony to the power and significance of accounting practices in ancient Egypt. More research is needed to further develop our appreciation of such power and significance. The visualising by accounting of the organisational, the technical, and the interdependent discussed in this paper has parallels in the intervention of accounting in numerous other organisations and societies, both ancient and contemporary. Any future theorising of accounting would require a further development of these dimensions of visibility and construction of new realities, and the special attributes and powers of re-presentation and reality construction that render accounting practices particularly adept in these contexts. More importantly, however, it is work on the dissolution of the sacred/secular divide relating to the nature of accounting that promises to be both most intriguing and challenging.

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A basic study of agency-cost source and municipal use of internal versus external control

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Abstract—This study examines the association between agency-cost source and the use of internal control versus external control in municipal control systems. Specifically, I focus on the *differences* between internal and external control to determine whether characteristics of underlying organisations might lead to differential demand for internal and external control. Differential demand is argued to be linked to the manager's position as principle or agent (or alternatively the presence of internal or external agency costs, respectively). Internal control is posited to be used specifically to address internal agency costs; external control is posited to be used specifically to address external agency costs. Results are consistent with these hypotheses. Cities facing high levels of agency costs from voters and creditors tend to hire Big 5 auditors or auditors with municipal experience, but generally do not employ internal auditors or certified finance officers. Also, cities facing high levels of agency costs from employees tend to employ internal auditors or certified finance officers, but generally do not hire Big 5 auditors or auditors with municipal experience. There does not appear to be widespread substitution of internal and external control to address agency problems in municipal organisations. For data availability contact the author.

1. Introduction

This study examines municipal decisions to increase internal control versus external control in response to different types of agency relationships. I specifically examine: (1) whether cities focus more on *internal* control when facing agency costs associated with internal sources such as employees, (2) whether cities focus more on *external* control when facing agency costs associated with external sources such as voters and creditors, and (3) whether cities readily substitute internal and external control across different agency combinations. Agency costs occur in most organisations due to the conflicting preferences and information asymmetry that often exists between managers and both internal and external parties (Jensen and Meckling, 1976). To reduce such costs, rational managers implement control systems, which are comprised of both internal and external control mechanisms (Abernethy and Chua, 1996; Simons, 1995).

The combination of internal and external control mechanisms in an organisation's control system depends on the manager's utility-maximisation function, which takes into account each mechanism's costs and benefits (Simunic, 1980). However, all things being equal, it is not clear why managers select internal mechanisms in some cases and external mechanisms in others. Indeed, fundamental differences in internal and external control have generally not been considered in prior research, nor have differences in organisations that might lead managers to select one over the other. Many important questions have yet to be considered. For example, is internal control used to address agency costs? Does it matter where agency costs come from? Do managers really substitute internal and external control for each other? Or do differences in the nature of internal and external control translate into different value under different circumstances? Answering these questions should improve our overall understanding of how internal and external control are used to add value to organisations, and should improve our understanding of the process whereby managers assemble control systems.

In this study, I examine the association between a manager's choice of internal versus external control and his position as principal or agent in an agency relationship (or alternatively, the source of agency costs). I posit that managers are more likely to increase the level of internal control (rather than external control) when they are principals in a relationship, or are concerned about agency costs

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associated with internal parties; and that they are more likely to increase the level of external control (rather than internal control) when they are agents in a relationship, or are concerned about agency costs associated with external parties. Research questions are examined by categorising a sample of municipal organisations (cities) according to whether they employ high or low levels of internal or external control and then by analysing differences in agency-cost proxies among them. Results are generally consistent with the hypotheses. Higher levels of internal (external) control are found in cities having higher levels of internal (external) agency costs. Further, cities which face high levels of agency costs from employees **only** (i.e. managers are principals) are more likely to use internal control mechanisms, but not external control mechanisms. And cities which face high levels of agency costs from creditors and voters **only** (i.e. managers are agents) are more likely to use external control mechanisms, but not internal control mechanisms. This suggests that municipal managers perceive the value of internal and external control mechanisms (in terms of reducing agency costs) to depend on the agency setting. Further, it suggests that internal and external control mechanisms may be substituted for each other only under very specific conditions (Jensen and Payne, 2003).

The remainder of this paper is organised as follows. First, prior research regarding the demand for internal and external control is reviewed, and a discussion of the fundamental differences between internal and external control is presented. Hypotheses are developed, and then tested using a sample of cities in the southern US. Finally, a discussion of the results and their ramifications are presented.

2. Theory and hypothesis development

2.1. Background

A common theme in prior research is that the demand for control is linked to the presence of agency costs (e.g., Chow, 1982; Craswell et al., 1995; DeFond, 1992). Studies show that agency costs can be reduced by hiring external control mechanisms such as external auditing (e.g., Francis and Wilson, 1988; Jensen and Meckling, 1976; Watts and Zimmerman, 1983). Studies also suggest that agency costs may be reduced by hiring internal control mechanisms such as internal auditing (e.g., Adams, 1994; Anderson et al., 1993; Simunic, 1980). While internal and external control mechanisms are similar in this way, they are fundamentally different by definition. External control mechanisms such as external audits are intended primarily to enhance the reliability of financial reporting, either directly by providing assurance or indirectly by increasing accountability among information providers. Internal control has a much broader purpose. Its stated objectives are to provide assurance regarding: (1) the reliability of financial reporting; (2) the effectiveness and efficiency of operations, and (3) compliance with applicable laws and regulations (COSO, 1994).

Although these overall differences exist, clearly some internal and external control mechanisms do have similar objectives (e.g., providing assurance regarding accounting information). Yet even in such cases, internal and external control are different by nature. For example, commonly-cited differences include relative diagnosticity and relative objectivity. Diagnosticity refers to the ability of a control mechanism to reliably signal a potential error or problem; objectivity refers to potential bias inherent in a control mechanism (Knechel, 2001). Conventional wisdom holds that internal control mechanisms can be more *diagnostic* than external control mechanisms because individuals involved in internal control are closer to the organisation. For example, Williamson (1985) argues that internal audit is more diagnostic than external audit because internal auditors have better access to information in all of the organisation's operations and systems, and because internal auditors are more likely to gain the cooperation of the organisation's employees due to longer-term relationships and due to common organisational membership. Indeed, longer-term and more intimate experiences with an organisation's operations provide internal auditors and others performing internal control tasks with a much deeper understanding of the organisation, its processes, its objectives, and its organisational risks than that normally held by external auditors. Moreover, internal control is not limited by materiality or GAAP in determining fair presentation of financial information.[1] Although no studies have specifically examined diagnosticity in internal versus external control, recent surveys by the Association of Certified Fraud Examiners (ACFE, 2002) indicate that fraud is more likely to be detected by internal control mechanisms than by external auditors (see also KPMG survey results cited in Kinney, 2000: 108–109).

Conventional wisdom also holds that external control mechanisms can be more *objective* than internal control mechanisms because individuals involved in external control are separate from the organisation. For example, Kinney (2000: p. 73) argues that 'since internal control is established and implemented primarily by management, it cannot assure those outside management that it functions effectively,' and that 'since management is instrumental in establishing and executing internal control, it can make the process self-serving, or management may improperly 'override' internal control and commit management fraud.' Along these lines, Williamson (1975) argues that while internal auditors can generally be expected to act in the interest of their organisations, external auditors are separate from the organisations they audit and by definition must act in the interest of external parties. Kinney (2000: 262) adds that 'even under the best of conditions, it is difficult for an internal auditor to be objective about evaluating and reporting...the performance of his or her own top management.' Although no studies have specifically examined objectivity in external versus internal control, the constant focus by regulators, the media, and the auditing profession on improving independence among external auditors, audit committees, and standard setters is consistent with this notion.

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[1] In contrast, external audits are generally limited in scope to identifying deviations from GAAP that would be material to the generic external user. Management usually has little if any input in determining the scope of the external audit.

2.2. *Prior research*

Early research examining the demand for control assumed that the control provided by internal and external mechanisms is similar, and even interchangeable (e.g., Simunic, 1980). Some of these studies are particularly relevant to the current study because they were conducted in the context of the public sector. For example, Zimmerman, (1977) examined the demand for auditing in the municipal market by identifying city manager forms of government as facing higher levels of agency costs than mayoral forms of government. He then showed that city managers are indeed more likely than mayors to hire auditors, and when they do they are more likely to hire larger (i.e. higher quality) auditors. Baber (1983) and Marks and Raman (1987) further tested this question by examining the relationship between state audit budget size and proxies for agency costs encountered by state governments in the US. Both studies found measures of size and political competition to be related to the size of audit budgets, although neither found significant results for debt levels. In a related study, Marks and Raman (1986) used state audit budget size as an explanatory variable, and found it to be positively (rather than negatively) associated with interest rates. Finally, returning to the context of municipal markets, Evans and Patton (1987) tested signaling as an alternative to monitoring and found reporting quality[2] to be more closely related to signaling variables (e.g., government type, active finance officer) than to monitoring variables (e.g., size, political competition). Interestingly, they did find a link between reporting quality and debt levels.

In summary, early research found a link between agency proxies and the demand for control. However, results were often inconsistent or even contrary to predictions. A weakness in these studies (and a possible explanation for their results) is that they did not identify internal and external control – and their respective quality levels – separately. For example, state audit budgets included outlays for both internal and external auditing activities, and even for activities unrelated to financial reporting. And the link between the CAFR award and the quality of control mechanisms is indirect at best (see Hackenbrack et al., 2000).

Many significant changes have occurred in public-sector accounting and auditing since these early studies.[3] Some of these changes provide an opportunity for more refined examination of municipal control systems (e.g., the current study). However, recent studies examining the demand for internal and external control have focused on other types of organisations. Although some of these studies do identify internal and external control as separate constructs, most continue to focus on their similarities rather than their differences. This has led some to continue examining external auditing as a proxy for the demand for all types of control (e.g., Abdel-Khalik, 1993). It has also led some to interpret correlations between internal and external control mechanisms in simplistic terms. For example, positive correlations are interpreted to indicate the two are viewed as complements (Abbott and Parker, 2000; Yeoh and Jubb, 2001); negative correlations are interpreted to indicate the two are viewed as substitutes (Gul et al., 2002; Jensen and Payne, 2003; Yeoh and Jubb, 2001). However, results in Anderson et al. (1993) suggest that such conclusions are premature. They note that internal and external control are fundamentally different in nature, suggesting that correlations in the presence or absence of internal and external control may be driven by characteristics of the underlying organisations, which in turn can increase or decrease the demand for internal control and external control independently. In a study closely related to the current study, Carey et al. (2000) find results that may illustrate the problem with assuming that correlations by themselves are informative. Using an agency framework, they examine the use of internal and external auditing by family businesses *not required to have audits* and find a negative correlation between internal and external audit. However, they find no direct relation between internal audit and agency proxies. They conclude that internal and external audit are likely being substituted for each other, but for reasons unrelated to agency costs. Unfortunately, the authors provide no suggestions as to what those reasons might be.

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[2] Evans and Patton (1987) measured reporting quality using participation in the Government Finance Officers Association's (GFOA) Certificate of Achievement for Excellence in Financial Reporting programmeme (CAFR).

[3] Changes include the requirement for most cities now to have external audits from independent CPAs, changes in single-audit requirements and their applicability, the evolution of governmental accounting towards private-sector accounting, specific CPE requirements for auditors of municipalities, and increased media attention on municipal accountability. In addition, internal control is much more actively promoted by regulators and the profession, and internal auditing is much more developed as a separate discipline.

2.3. Hypothesis development

If the demand curves for internal and external control are not the same, there are likely to be many organisational characteristics that help explain the difference. One characteristic likely to lead to differential demand is the manager's position as principal or agent, or synonymously the predominance of agency costs associated with internal versus external sources. The most commonly examined agency relationships are those that exist between managers and individuals outside their organisations to whom they are accountable. Such individuals include creditors, shareholders, voters, regulators, and others. Because these parties cannot monitor managers' behaviour directly, they must rely on the information provided by managers to make decisions. Such information includes accounting information. In such relationships, the manager is an agent. Given the assumed information asymmetry and/or different interests, external decision makers (principals) are likely to discount any accounting information provided by managers. This information risk increases the demand for control. Under these circumstances, agency theory predicts that managers will hire control mechanisms to reduce this information risk as long as the perceived benefits of doing so are greater than the costs (Craswell et al., 1995).

Internal control mechanisms may provide some assurance to external parties *if the manager can communicate their existence to those parties* (see Raman and Wilson, 1994). However, the arguments noted earlier by Kinney (2000) and Williamson (1975, 1985) suggest that internal mechanisms may be perceived by external users as being insufficiently objective to reduce information risk at the rate desired by the manager. After all, the same management providing the accounting information may also have the power to override internal controls. On the other hand, external control mechanisms are separate from management, and its increased objectivity may lead to its being perceived as a more efficient tool in reducing information risk.

Less commonly examined are agency relationships that exist between managers and individuals within their organisations (e.g., employees). In such relationships, the manager is a principal rather than an agent. As organisations get larger, managers' ability to monitor their employees diminishes (Abdel-Khalik, 1993; Williamson, 1975). Increasingly they must rely on information provided by employees to make decisions. Some of this is accounting information. Given the assumed information asymmetry and potentially different interests between managers and employees, the reliability of this information must also be questioned. This also increases the demand for control. Under these circumstances, agency theory predicts that managers will hire control mechanisms to reduce the information risk they face as long as the perceived benefits of doing so are greater than the costs (Craswell et al., 1995). Abdel-Khalik (1993) argues that under these circumstances, managers may hire external auditors (external control) to provide this assurance. However, the arguments by Kinney (2000) and Williamson (1985, 1975) suggest that managers are likely under these circumstances to favor internal control mechanisms, as they are interested in making sure information is complete and reliable rather than making sure someone else is convinced it is complete and reliable. In other words, diagnosticity is likely to be assigned more weight because of managers' personal motivation to make good decisions. In addition, since managers are involved in creating control mechanisms in the first place, objectivity is likely to be assigned less weight. Moreover, the flexibility provided by internal control may be valued by managers in controlling the behaviour of the organisation's employees in other ways.

This discussion suggests that internal control is likely to provide greater benefits (in the form of reduced agency costs) when such costs originate with internal parties such as employees. It also suggests that external control is likely to provide greater benefits (in the form of reduced agency costs) when such costs are associated with external parties such as creditors and voters. The discussion also suggests that the two are not obvious substitutes as previously assumed. This leads to the following hypotheses:

H_1: Increased use of internal control by municipalities is associated with the presence of agency costs from internal sources (i.e., managers are principals).

H_2: Increased use of external control by municipalities is associated with the presence of agency costs from external sources (i.e., managers are agents).

H_3: *Ceteris paribus*, municipalities do not substitute internal (external) control mechanisms for external (internal) control mechanisms in addressing external (internal) agency costs.

H_1 and H_2 examine whether agency-cost type motivates cities to implement internal and external control, respectively. While results supporting H_1 have been found in other studies (e.g., Carey et al, 2000), this study would be the first to find results consistent with H_2. H_3 is of particular interest because it specifically addresses the question of interchangeability. Results supporting H_3 would indicate that internal (external) control is viewed as being more valuable than external (internal) control in reducing agency costs from internal (external) sources.

3. Method

Hypotheses are tested using a sample of municipal organisations (cities) of various sizes *who are required to have audits*. Jensen and Payne (2003) note the advantages of using cities to study economic questions about the market for audit services in an agency framework. Foremost among these is the fact that municipalities experience agency costs associated with both internal and external parties.[4] Although the absence of shareholders in the municipal market greatly reduces the dominance of external agency costs across the market, external agency costs generally arise from cities' relationships with voters and creditors (Banker et al., 1992; Zimmerman, 1977).[5] Given the variations in these relationships, some cities may be virtually unconcerned about external agency costs – a condition not likely to exist among publicly traded companies. These facts may help explain why municipal audit markets are more heterogeneous than other audit markets and why they are not dominated by the Big 5 audit firms (Hackenbrack et al., 2000). The availability of municipal information also provides large amounts of data in one homogeneous industry, reducing considerably the risk of omitted variables. Several studies have exploited these facts to provide insights into management behaviour (e.g., Bandyopadhyay and Kao, 2001; Copley et al., 1995).

3.1. Internal and external control

In order to distinguish between cities choosing internal versus external control, several common control mechanisms are identified. Using multiple control mechanisms from each category helps reduce the likelihood of cities being misclassified simply because they opt for one mechanism over the other. Internal control is identified by the presence of at least one of two internal mechanisms closely linked to the objective of increasing information reliability. First, external auditors frequently use the work of internal auditors to reduce the amount of work they must perform on audits. There also appears to be a trend towards outsourcing internal audit responsibilities to public accounting firms.[6] These observations suggest considerable overlap between internal and external audit objectives and procedures. Carey et al. (2000) identify internal and external auditing as likely substitutes in addressing the agency problem (see also Jensen and Payne, 2003).

Second, chief financial officers with higher levels of accounting and finance expertise should be able to provide higher-quality oversight and direction to the financial reporting process than those without. Indeed, providing finance officers with training in this regard may be an efficient way of increasing internal control for cities reluctant to hire internal auditors because of resource constraints. This may help explain the results in Carey et al. (2000), where the organisations they studied were perhaps too small to have the resources to hire internal auditors. Evans and Patton (1987) show that higher-quality municipal finance officers are more likely to participate in the CAFR programme (i.e. provide better reporting quality). While that study uses finance-officer salary as a proxy for quality, finance officer certification is perhaps a more generally accepted quality measure. The most common and most prestigious certification available to municipal finance officers is the Certified Public Finance Officer (CPFO) programme sponsored by the Government Finance Officers Association (GFOA).[7] Given this discussion, the current study considers a city to employ higher levels of internal control if it has either: (1) a chief accountant who is a Certified Public Finance Officer (CPFO), or (2) internal auditors.

The most obvious external control mechanism available to managers is the external audit. However, the decision to have an external audit or not is difficult to observe now that most cities are required to have an external audit each year. Fortunately, one can still observe the choice between auditors likely to provide higher or lower levels of assurance (control). This notion is used in the current study. In other words, higher or lower levels of external control are identified using measures that differentiate audit firms providing 'normal' levels of assurance and audit firms likely to provide higher levels of assurance due to higher perceived audit quality. One way to identify audit firms falling into the latter category is to identify those firms who have more invested in their reputations. Such firms are likely to employ higher-paid auditors, invest more audit effort, and perhaps demand lower levels of audit risk. Previous research suggests that both audit-firm size (e.g., DeAngelo, 1981) and auditor industry experience (e.g., Craswell et al., 1995) are reasonable proxies for increased assurance in this regard. Hence, the current study considers a city to employ higher levels of external control if its auditor is either: (1) a Big 5 audit firm, or (2) an auditor who performs multiple municipal audits in the same year (an auditor with industry experience).[8]

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[4] Jensen and Meckling (1976) propose agency theory as a *general* theory of organisations. They point out that agency costs associated with internal and external sources exist in all organisations, including governments.

[5] Baber (1983) asserts that while individual voters are not likely to pay much attention to municipal management, they form interest groups that do pay attention.

[6] Public companies in the US are prohibited from having the same accounting firm perform both internal and external auditing. This restriction does not currently hold for private companies, non-profits, and the public sector.

[7] The CPFO certification is a rigorous programme used to identify high-quality government finance officers. Holders of this certificate must have a bachelors degree, attain several years of government finance experience, pass a five-part examination, and complete regular CPE. A similar certification programmee called the Certified Government Financial Manager programme (CGFM) is administered by the Association of Government Accountants. Participation in the CGFM programme was less common among cities in the current study. In every case in the sample where the chief finance officer was a CGFM, he or she was also a CPFO.

3.2. Agency cost proxies

Agency-cost proxies are also identified for each of the primary agency-cost sources in the public sector. This allows managers' dominant role as principal or agent to be identified. The primary *internal* sources of agency costs in cities are employees (Banker et al., 1992). Abdel-Khalik (1993) argues that internal agency costs arise when organisational growth leads to 'a longer chain of command and decreased observability of subordinates' actions.' He goes on to suggest that the obvious way to address such costs would be to use internal control mechanisms. However, he chooses to focus on external auditing instead because he notes that at the time of his study, internal control systems (including internal auditing) were generally not well-developed. The current study adopts Abdel-Khalik's (1993) approach of using organisational size as a proxy for organisational loss of control (i.e. internal agency costs). The primary metric used to measure organisational size is total annual municipal expenditures (Hackenbrack et al., 2000).[9]

The primary *external* sources of agency costs in cities are creditors and voters (Banker et al., 1992). The amount of external debt owed by a city appears to be a reasonable proxy for the level of agency costs associated with creditors (although research noted earlier found only mixed results for debt metrics). Hence, the primary metric used to measure external debt in this study is total long-term debt from the financial statements.[10]

Measuring agency costs associated with voters is more problematic. Such costs are assumed to be higher when voters are more politically active, or are more likely to vote in a given municipal election. And relevant metrics are not available in the financial statements. Some previous studies used political-competition indices to measure voter-related agency costs (Evans and Patton, 1987; Baber, 1983), but found insignificant results. And Marks and Raman (1987) used generic culture-type categories to measure voter-related agency costs, but their results are difficult to interpret (both statistically and conceptually). Fortunately, the political science literature has examined the link between voter characteristics and voting activity quite extensively. The current study draws heavily from that literature in identifying proxies for voter-related agency costs.

Researchers generally considers voters to be rational decision makers whose voting behavior is associated with the perceived costs and benefits of voting (e.g., Filer et al., 1993). Indeed, perhaps the most common explanation for voter participation is socioeconomic status (Wolfinger and Rosenstone, 1980). Citing their own findings as well as the literature's, Verba and Nie (1972) state: 'Citizens of higher social and economic status participate more in politics. This generalisation has been confirmed many times in many nations. And it generally holds true whether one uses level of education, income, or occupation as the measure of social status.' Income has consistently been shown in cross sectional studies to be positively associated with the likelihood of voting (e.g., Cox and Munger, 1989; Leighly and Nagler, 1992; Verba et al., 1993). The primary explanation for this is that individuals who pay more in taxes have a larger stake in decisions involving the use of tax dollars (see also Copley et al., 1995). As income increases, so do the benefits of voting. Education level has also consistently been shown to be positively associated with the likelihood of voting (e.g., Leighley and Nagler, 1992; Patterson and Caldeira, 1983; Wolfinger and Rosenstone, 1980). The primary explanation for this is that the cost of voting decreases as one becomes more educated, since educated individuals

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[8] This measure of experience is made at the office level rather than the firm level in order to capture team experience rather than firm-wide experience. This is important in the municipal market since firms may appear to have more municipal experience simply because they have offices in multiple cities. Offices performing audits of multiple cities in a given year are much rarer than firms that do so. This measure of experience does not capture time-series properties (e.g., auditing a city for multiple years or turnover among audit staff). Nevertheless, similar measures have been shown to be associated with higher audit quality (e.g., O'Keefe et al., 1994).

[9] Many studies use population as a measure of city size. However, since this study focuses on the size of the organisation itself, expenditures are considered a better measure. Other size metrics are used in sensitivity analysis. Also, because total expenditures has a skewed distribution, the natural log of expenditures is used in all analyses.

[10] Data problems arise because debt is highly correlated with expenditures (r=.77). For this reason analyses use long-term debt deflated by expenditures. Similar transformations used in prior research include per-capita debt (Marks and Raman, 1986), debt to revenues (Marks and Raman, 1987), and debt to assets (Carey et al., 2000).

Table 1
Descriptive statistics for sample cities (n=318)

Panel A: General description of the sample of cities.

Characteristic	*Mean or Percentage*	*Median*	*Range*
Population	43,789	16,000	5,000 – 1,630,672
Total annual expenditures (in thousands)	$65,489	$19,008	$1,340 – 2,256,768
Total long-term debt (in thousands)	$87,160	$16,950	$0 – 4,691,805
Median family income	$31,875	$29,988	$13,194 – 99,625
Debt/expenditures (leverage)	0.94	0.87	0 – 3.49
Over 25 with high school education	0.78	0.78	0.47 – 0.99
Over 25 with Bachelors Degree	0.24	0.20	0.07 – 0.77
City manager form of government	0.68		
City has certified finance officer	0.24		
City has internal auditors	0.20		
Auditor is Big 5 firm	0.13		
Auditor has elevated municipal experience	0.47		

Panel B: Distribution of control conditions in city sample.

	Low internal control	*High internal control*[a]	*Total*
Low external control	104	53	157
High external control[b]	90	71	161
Total	194	124	318

[a] Cities are classified as having high levels of internal control if they have internal auditors or their chief finance officer is a certified public finance officer (CPFO).

[b] Cities are classified as having high levels of external control if their auditor was a Big 5 auditor or their auditor performed multiple municipal audits during 1998.

are better able to search for relevant information to draw distinctions between the candidates. Of course, there is also an obvious connection between educational attainment and income levels.

Relying on these findings, this study uses voter income and voter education levels as proxies for voter-related agency costs. The primary metric used to measure voter income is a city's median family income as identified by the US Census Bureau. And the primary metric used to measure a city's voter education level is the percentage of individuals over 25 in a city having a high school education as identified by the Bureau.[11]

3.3. Data

Surveys were sent to all 928 cities with populations greater than 5,000 in eight southern states in the US.[12] Information gathered in these surveys identified which cities had internal auditors and/or finance officers who were Certified Public Finance Officers. It also identified the audit firms who performed the audits of the city's 1998 fiscal-year-end financial statements. Financial statements were obtained directly from the cities or from the US Census Bureau. Expenditures and long-term debt metrics were obtained from the financial statements. Median family income and educational levels were obtained from the US Census Bureau website (Census, 2000). Big 5 status and the office of the firm performing the audit were identified using the surveys or the auditor's report accompanying the 1998 financial statements. Auditor municipal experience was determined by counting the number of municipal audits performed by a particular office of an audit firm.

The office of the audit firm performing the audit was identified in 615 of the 928 cities. Offices performing more than one municipal audit during 1998 were classified as experienced auditors.[13] After eliminating observations with missing data, the final sample includes 318 cities. Descriptive information for this sample is shown in Panel A of

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[11] Data problems arise because median family income and the percentage of individuals over 25 with a high school education or bachelors degree are highly correlated (r=.75, and r=.77 respectively). For this reason, median family income is used in all primary analyses, with education level being shown only in sensitivity tests.

[12] States included Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Texas.

[13] Since it is unclear how much industry experience is required to increase quality, a conservative threshold of more than one municipal audit is used. Increasing this threshold to offices performing more than two municipal audits yields similar results.

Table 1. The distribution of these cities in terms of internal and external control is shown in Panel B of Table 1. The sample is fairly evenly distributed with 124 cities classified as having high internal control (48 with internal auditors only, 59 with certified finance officers only, and 17 with both) and 161 cities classified as having high external control (11 with a Big 5 auditor only, 120 with an experienced auditor only, and 30 with both). Additionally, 71 cities are classified as having both high internal and high external control while 104 cities are classified as having neither.

4. Empirical results

4.1. Primary analysis

Initial tests of H_1 and H_2 are performed in a manner similar to Carey et al. (2000). Cities are categorised according to (1) whether they have high or low internal control, and (2) whether they have high or low external control, and agency-cost proxies are summarised for each category. T-tests and logistic regression are then used to examine the relationship between the presence of internal or external control and the different agency-cost proxies. Univariate results shown in Table 2 indicate that cities with high internal control are significantly larger than cities with low internal control and that cities with high external control have significantly higher debt and income levels than cities with low external control. These results are consistent with H_1 and H_2-internal control is associated with the presence of internal agency costs, and external control is associated with the presence of external agency costs. These results also speak to H_3 to some degree as external agency costs (debt and income levels) are not associated with the use of internal control, indicating that internal control is generally not viewed as a substitute for external control in this regard. Results also show that cities with high external control are larger than cities with low external control. This is consistent with Abdel-Khalik (1993), who showed that organisations may use external control to augment internal control. However, it is not clear from this analysis whether such behavior is occurring, or whether the results are driven by the presence of cities demanding both internal and external control.

To capture the effects of all three agency proxies simultaneously, the following logistic models are also estimated:

$$\text{INTCON} = \alpha_1 + \alpha_2\text{LEXP} + \alpha_3\text{DEBT\%} + \alpha_4\text{INCOME} \quad (1a)$$

and

$$\text{EXTCON} = \beta_1 + \beta_2\text{LEXP} + \beta_3\text{DEBT\%} + \beta_4\text{INCOME} \quad (1b)$$

where:

INTCON = 1 if the city had internal auditors or a chief finance officer who was a certified public finance officer, 0 otherwise;

EXTCON = 1 if the city's auditor was a Big 5 auditor or an auditor performing multiple municipal audits during 1998, 0 otherwise;

LEXP = the natural log of total expenditures for 1998;

DEBT% = the total debt at the end of 1998 deflated by total expenditures for 1998; and

INCOME = the city's median family income in thousands.

Collinearity does not appear to be problem in these models, as the highest correlation coefficient among the explanatory variables is only $r=.14$. Results of the logit models are shown in Table 3. Both models are significant at $p<.01$ with pseudo-R^2 of 11% and 10% for the internal and external control models respectively. These R^2 values compare favorably to the 2% and 14% in Carey et al. (2000) for internal and external control models respectively. Results of hypothesis tests are consistent with the univariate results above. The coefficient on LEXP is significant and positive in the internal control model (consistent with H_1), while the other coefficients are not significant. And the coefficients on DEBT%, and INCOME are both significant and positive in the external control model (consistent with H_2).[14] The coeffi-

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[14] Given the general nature of the variables used in the above models, a significant risk exists that results are driven by correlated omitted variables. For this reason, a number of sensitivity tests are performed using variations of equations (1a) and (1b). First, alternative measures for each agency-cost proxy are substituted into the model. Alternative measures of employee-related agency costs include the log of population and the log of the number of funds included in the financial statements. Results using these variables in place of LEXP are qualitatively similar to those shown in Table 3. Alternative measures of creditor-related agency costs include per-capita debt and the log of total debt. Results using these variables in place of DEBT% are also qualitatively similar to those shown in Table 3 except that per-capita debt is no longer significant in the external control model. Marks and Raman (1986) also found insignificant results for per-capita debt. Alternative measures for voter-related agency costs include the percentage of a city's citizenry over 25 having a high-school diploma and the percentage of a city's citizenry over 25 having a bachelors degree. Results using these variables in place of INCOME are also qualitatively similar to those shown in Table 3. Second, indicator variables are added to the model to control for other municipal characteristics that are likely to affect the overall demand for control or auditor type. These include: (1) a city manager form of government, (2) the presence of an audit committee, (3) a requirement to have a single audit, and (4) a busy-season audit. Results for the test variables after including these control variables remain qualitatively similar to those in Table 3. These results increase the persuasiveness of the results in supporting for H_1 and H_2 by increasing the likelihood that the measures of internal and external agency costs used are representationally faithful.

Table 2
Univariate analysis of agency-cost proxies for cities having high or low levels of internal and external control (n=318)

Mean/Median (Std. Dev.) Proxy	*Cities with high internal control*[a] *(n=124)*	*Cities with low internal control (n=194)*	*t-value*	*Cities with high external control*[b] *(n=161)*	*Cities with low external control (n=157)*	*t-value*
Expenditures (thousands)	118,535/39,370 (278,429)	31,582/15,367 (49,841)	3.44*	93,672/33,784 (247,855)	36,587/15,401 (56,535)	2.85*
Debt/expenditures	0.94/.87 (0.56)	0.94/.87 (0.65)	0.11	1.05/.99 (0.66)	0.82/.80 (0.56)	3.23*
Median family income	31,630/30,743 (9,023)	32,031/28,693 (12,104)	0.34	34,830/31,925 (12,164)	28,844/27,598 (8,690)	5.06*

[a] Cities are classified as having high levels of internal control if they have internal auditors or their chief finance officer is a certified public finance officer (CPFO).
[b] Cities are classified as having high levels of external control if their auditor was a Big 5 auditor or their auditor performed multiple municipal audits during 1998.
* indicates two-tail significance at $p < .01$.

Table 3
Logistic analysis of agency-cost proxies in cities having higher levels of internal or external control (n=318)

Models: 1a: $INTCON = \alpha_1 + \alpha_2 LEXP + \alpha_3 DEBT\% + \alpha_4 INCOME$

1b: $EXTCON = \beta_1 + \beta_2 LEXP + \beta_3 DEBT\% + \beta_4 INCOME$

Variables:[c]	*Model 1a*[a]	*χ^2-value*	*Marginal Effect*[b]	*Model 1b*[a]	*χ^2-value*	*Marginal Effect*
Intercept	–11.22 (1.88)	35.65***		–8.24 (1.79)	21.21***	
LEXP	0.67 (0.11)	35.18***	0.432	0.37 (0.10)	12.16***	0.196
DEBT%	–0.22 (0.21)	1.09	–0.129	0.42 (0.20)	4.32**	0.199
INCOME	–0.01 (0.01)	1.17	–0.246	0.05 (0.01)	16.24***	0.857
Model χ^2-value	41.91***			46.80***		
McFadden's R-square	0.11			0.10		

***, **, two-tail significance at $p < .01$, .05 respectively.

[a] Cells contain parameter estimates (standard errors).

[b] Marginal effects are computed by taking the partial derivative of the predicted probability with respect to the explanatory variable at its median while holding the other explanatory variables constant at their medians.

[c] Variables are defined as follows:

INTCON = 1 if the city had internal auditors or a chief finance officer who was a certified public finance officer, 0 otherwise;
EXTCON = 1 if the city's auditor was a Big 5 auditor or an auditor performing multiple municipal audits during 1998, 0 otherwise;
LEXP = the natural log total municipal expenditures from the 1998 financial statements;
DEBT% = the total long term debt from the 1998 financial statements as a percentage of total expenditures;
INCOME = the median family income for the city per the US Census Bureau.

cient on LEXP is also significant and positive in the external control model.

Although hypothesis tests do not require interpretation of coefficient magnitudes (other than determining whether they differ significantly from zero), marginal effects are also presented in Table 3. Marginal effects are computed by taking the partial derivative of the predicted probability with respect to the explanatory variables at their medians while holding other explanatory variables constant.[15] Results are similar to elasticities; they show the increase in the probability of the dependent variable being equal to one for a percentage (or unit) change in an explanatory variable. For example, a one percent increase in municipal expenditures increases the likelihood of a city having internal and external control by 0.432 and 0.196%, respectively.[16] And 1% increases in a city's debt percentage and median family income increase the likelihood of a city having external control by 0.199% and 0 .857%, respectively.

Although some of the above results speak to H_3, specific tests of H_3 require an examination of specific links between control conditions and the presence *and absence* of internal and external agency costs. For example, if H_3 is descriptive, one would expect cities with high internal control but low external control to have high levels of agency costs from employees *but not from voters or creditors*. And one would expect cities with high external control but low internal control to have agency costs from voters and creditors *but not from employees*. Such results would indicate that internal and external control are not substituted widely for each other, but that each is preferred over the other given certain agency relationships.

To isolate this differential demand, cities are divided into two groups: (1) cities with high internal

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[15] Given the nonlinear form of the model, marginal effects may vary for different values of the explanatory variables. For this reason, medians were selected as a representative value. The presented effects are valid at those points. Marginal effects at the means are slightly lower.

[16] For ease in interpretation, the marginal effects of expenditures were computed using a percentage change in raw expenditures rather than the transformed expenditure.

Table 4
Univariate analysis of agency-cost proxies in cities having low overall control, high internal control only, or high external control only (n=247)

	Agency proxy	*Cities with low internal and low external control (n=104)**	*Cities with high internal control only (n=53)*	*Cities with high external control only (n=90)*
Expenditures (thousands)	mean	29,771^{a}	49,963^{a,b}	33,677^{b}
	median	12,875	19,476	18,100
	std. dev.	(48,051)	(68,846)	(52,025)
Debt/expenditures	mean	0.80^{c}	0.89^{d}	1.10^{c,d}
	median	0.75	0.86	1.02
	std. dev.	(0.57)	(0.53)	(0.71)
Median family income	mean	28,745^{e}	29,039^{f}	35,829^{e,f}
	median	27,383	28,237	31,201
	std. dev.	(9,130)	(7,835)	(13,930)

* Cities are classified as having internal or external control using the same criteria as in Table 2.
$^{a, b, c, d, e, f}$ Metrics having the same letter are significantly different (using t-tests) at least at p<.10 (one-tail).

control but low external control, and (2) cities with high external control but low internal control. A group made up of cities having low internal and low external control is also included as a control condition.[17] Descriptive statistics and univariate tests among the resulting three categories are shown in Table 4. Cities with internal control only are significantly larger than cities with neither internal nor external control; however, as predicted they do *not* have significantly higher debt or income levels. Meanwhile, cities with external control only have significantly higher debt and income levels than cities with neither internal nor external control; however, as predicted, they are not significantly larger. Finally, cities with internal control only are significantly larger than cities with external control only, and cities with external control only have significantly higher debt and income levels than cities with internal control only.

Nominal (multinomial) logistic regression forms of equation (1) are then used to examine simultaneous effects. This approach is recommended by Maddala (1983, 1991) when more than two non-ordered (categorical) response categories exist. Nominal logistic regression provides parameter estimates that can be interpreted despite this lack of ordering in the dependent variable, as it simultaneously estimates the generalised logits for each pair of dependent variable categories. These generalised logits and model diagnostics are shown in Table 5. The overall ANOVA indicates that each of the agency-cost proxies is significant to the model. The p-value for the likelihood ratio test is 0.49, indicating a reasonably good model fit.[18] In each the generalised logits, the coefficient are significant in the predicted direction. When comparing internal control only to no control, the coefficient on LEXP is significantly positive while the coefficients on DEBT% and INCOME are not significant. When comparing external control only to no control, the coefficients on DEBT% and INCOME are significantly positive while the coefficient on LEXP is not significant. Finally, in perhaps the most revealing comparison between the external only group and the internal only group, the coefficients on DEBT% and INCOME are significantly positive while the coefficient on LEXP is significantly negative. In other words, given two types of cities – one with internal control and one with external control – cities facing agency costs from employees are more likely to be internal control users, while cities facing agency costs from creditors and voters are more likely to be external control users.

Together, these univariate and logistic results are consistent with all three hypotheses, but H_3 in particular. They suggest that the choice of control mechanisms in cities is very closely related to the specific agency-cost source, and that widespread substitution between internal and external control does not occur. Cities facing agency costs from employees respond with higher internal control, *not*

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[17] A fourth group made up of cities having high internal and high external control is not used here. Since such cites have both types of control (and are likely to face agency costs from both internal and external sources), it would be difficult to identify whether substitution is taking place across agency costs combinations. Sensitivity tests do examine this fourth group.

[18] The likelihood ratio test compares the likelihood ratio from the specified model with that of the unrestricted model. Significant p-values (i.e. $p < .10$) are associated with poorly-fitted models.

Table 5
Nominal logistic analysis of agency-cost proxies in cities having low overall control, high internal control only, or high external control only (n=247)[a]

Model: $\text{Control Category} = \alpha_1 + \alpha_2\text{LEXP} + \alpha_3\text{DEBT\%} + \alpha_4\text{INCOME}$

Source	*DF*	*Overall ANOVA Chi-Square*	*p-value*
Intercept	2	9.74	0.0077
LEXP	2	7.01	0.0301
DEBT%	2	7.95	0.0188
INCOME	2	16.18	0.0003
Likelihood Ratio	486	486.33	0.4872

Variables:[b]	*Pred.*	*Internal Only v. None*[c]	*Pred.*	*External Only v. None*[c]	*Pred.*	*External Only v. Internal Only*[c]
Intercept		–7.94*** (2.72)		–5.61** (2.49)		2.34 (2.78)
LEXP	+	0.43*** (0.16)	ns	0.19 (0.15)	–	–0.25* (0.16)
DEBT%	ns	0.20 (.30)	+	0.69*** (0.25)	+	0.50** (0.30)
INCOME	ns	–0.01 (0.02)	+	0.05*** (0.02)	+	0.06*** (0.02)

[a] Three nominal categories are used as the dependent variable following the criteria in Table 2. The DV is coded 1 if the city has neither internal nor external control; 2 if the city has internal control only; 3 if the city has external control only. Multinomial logistic analysis was performed using the CATMOD procedure in SAS, which simultaneously estimates the generalised logistic regressions for each pair of nominal DV categories.

[b] Variable definitions are shown in Table 3.

[c] Cells contain parameter estimates (standard errors).

***, **, * one-tail significance at $p < .01$, .05, and .10 respectively.

higher external control. And cities facing agency costs from creditors and voters respond with higher external control, *not higher internal control.*[19]

4.2. Alternative analysis

An alternative approach to testing H_1–H_3 is offered by categorising cities according to the presence and absence of agency costs from different sources and then examining the type of control system they use. The attractiveness of this approach is that it follows the direction of the predicted relationships more closely – that is, control mechanisms are a response to agency costs. The disadvantage of this approach, however, is that agency cost proxies are continuous, and it is difficult to identify the thresholds above which agency costs are considered high enough to elicit a response. Given this dilemma, medians are used as the primary threshold for categorising agency conditions. Cities having expenditures above (below) the median for the 318 cities in the sample are classified as facing high (low) levels of agency costs from employees. And cities having income or debt levels above (below) the median for the 318 cities in the sample are classified as having high (low) levels of agency costs from voters and creditors, respectively.

Proportions tests are used to test each of the hypotheses. Results (not shown) indicate that 52% of cities classified as having high internal agency costs use internal control, whereas only 26% of cities classified as having low internal agency costs do so ($z=4.60$, $p<.001$). Results (not shown) also indicate that 64% of cities classified as having high levels of voter-related agency costs use external control, whereas only 36% of cities classified as having low levels of voter-related agency costs do so ($z=5.05$, $p<.001$). And results (not shown)

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[19] Sensitivity tests are provided by estimating the generalised logits using all four categories. In each case, results are qualitatively similar to those shown in Table 5. Additionally, in the Both versus External Only comparison, LEXP is significant and positive while DEBT% and INCOME are not significant (as expected). And in the Both versus Internal Only comparison, INCOME and LEXP are significant and positive while DEBT% is not significant.

Table 6
Analysis of control conditions under different risk combinations (n=318)

Panel A: Agency cost combinations

	Low external agency costs	*High external agency costs b*	*Total*
Low internal agency costs	96	63	159
high internal agency costs[a]	63	96	159
Total	159	159	318

[a] Cities were classified as having high internal agency costs if total expenditures were greater than the median for all 318 observations from Table 1.
[b] Cities were classified as having high external agency costs if the median family income was greater than the median for all 318 observations from Table 1.

Panel B: Comparisons of control systems under different agency cost combinations

	Control system[a]				
Agency cost combination	*No control*	*Internal control*[b] *only*	*External control*[b] *only*	*Internal and external control*	*Total*
Low internal Low external	52 (54.2%)[c]	14 (14.6%)[d]	23 (24.0%)[e]	7 (7.2%)[f]	96 (100%)
High internal Low external	17 (27.0%)[c]	18 (28.6%)[d]	15 (23.8%)[e]	13 (20.6%)[f]	63 (100%)
Low internal High external	19 (30.1%)[c]	11 (17.5%)[d]	23 (36.5%)[e]	10 (15.9%)[f]	63 (100%)
High internal High external	16 (16.7%)[c]	10 (10.4%)[d]	29 (30.2%)	41 (42.7%)[f]	96 (100%)
Total	104	53	90	71	318

[a] Highlighted cells represent the predicted control system for each agency cost combination.
[b] Cities are classified as having high levels of internal control if they have internal auditors or their chief finance officer is a certified public finance officer (CPFO). Cities are classified as having high levels of external control if their auditor was a Big 5 auditor or their auditor performed multiple municipal audits during 1998.
[c, d, e, f] In each column, cells having the same letter indicate the proportion of cities having the predicted (highlighted) control system is significantly greater than the proportion of cities with other agency cost combinations having the same control system at least at p<.10.

also indicate that 65% of cities classified as having high levels of creditor-related agency costs use external control, whereas only 36% of cities classified as having low levels of creditor-related agency costs do so (z=5.27, p<.001). These results are consistent with H_1 and H_2.[20]

In order to test H_3, cities are classified according to their agency-cost combinations so that the predicted presence and absence of control can be linked to the presence and absence of specific agency costs. This process places each city in one of four categories: (1) low internal and low external agency costs, (2) high internal and low external agency costs, (3) low internal and high external agency costs, and (4) high internal and high external agency costs. The distribution of agency cost combinations is shown in Panel A of Table 6.

Tests of H_3 are then performed by extending the proportions tests to include each of the four agency cost combinations and each of the four possible control systems.[21] Results are shown in Panel B of Table 6. Note that for each agency cost combination, the number of cities using the predicted control system is greater than the number using any other control system. In addition, statistical tests indicate that the proportion of cities using the predicted control system for each agency combination is significantly greater than the proportion using that control system by each of the other agency combinations in all cases except but one (where the proportion is greater but not significantly so). For example, for cities facing agency costs from internal sources only, 29% use only internal control in their control system. At the same time, only 15% of cities facing no agency costs, 18% of cities facing agency costs from external sources only, and 10% of cities facing agency costs from both internal and external source use similar control systems (internal control only). These results are consistent with H_3.

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[20] Since the distribution for each of these variables is skewed, these analyses are also conducted using their means as categorisation thresholds. Results are qualitatively similar to those described above.

[21] Since voter-related agency costs appear to be stronger than creditor-related agency costs in the previous analyses, income is used to identify high or low external agency costs. However, sensitivity analysis is performed using debt to identify high or low external agency costs. Although results are generally consistent with those in Table 6, they are somewhat weaker as expected.

In summary, using an alternative approach, even with considerable noise introduced by the arbitrary selection of medians as the agency-cost thresholds, results are generally supportive of the hypotheses. Cities appear to use internal control mechanisms to address agency costs from internal sources, and cities appear to use external control mechanisms to address agency costs from external sources. Although there may be some substitution between internal and external control, such behavior does not appear to be widespread. Overall, the results suggest that cities view internal and external control differently in relation to the agency problem.

5. Conclusion

Internal and external control mechanisms are different by definition. Even among internal and external mechanisms having the same objective – to enhance information reliability – there are fundamental differences. This study takes these differences into account to offer a unique perspective of the differential demand for internal and external control. While there are probably many factors affecting managers' choice of internal versus external control, this study suggests that one factor is the agency costs source, or alternatively whether a manager is a principle or agent in salient relationships with internal and external parties. Results are consistent with this notion.

This study contributes in several ways to our understanding of the demand for control. First, previous research tended to view internal and external control in terms of their similarities, concluding that they are either substitutes or complements. The study provides evidence that different organisational characteristics such as specific agency relationships help determine the optimal control system. Internal and external control mechanisms may be positively or negatively correlated because of similarities or differences in the underlying organisations. In other words, correlations may be indicative of much more than whether control mechanisms are substitutes or complements. Second, this is the first study to find a significant link between the use of internal control and the presence of agency costs. Indeed, Carey et al. (2000) concluded that internal control was not used to address agency costs. Third, this is the first study to identify significant agency costs associated with voters in a municipal setting. Although researchers have often noted that voters are the primary sources of external agency costs in the public sector (e.g., Banker et al., 1992; Zimmerman, 1977), many have not considered such costs to be significant (e.g., Baber, 1983). Finally, this study contributes to our understanding of the demand for assurance by providing further evidence that agency theory is useful in explaining the demand for auditing and other forms of control.

As with all studies, this one has limitations. First, this study uses proxies for the underlying variables of interest. To the extent that proxies for internal and external agency costs, and for internal and external control are measured well by the chosen variables, this study's interpretation of the results are likely to be valid. However, to the extent that these proxies are correlated with other unknown omitted variables, such interpretations may be incorrect. I used extensive sensitivity analysis to reduce this risk, but the omitted variables problem cannot be eliminated. Second, this study does not address the noise introduced to the analysis by cities hiring internal and external control mechanisms for objectives other than information reliability. This study focuses on control as it relates to information reliability only. Many control mechanisms – particularly internal control mechanisms – are designed to align the motives of principles and agents rather than monitor information and provide assurance. Indeed, many internal control mechanisms have nothing to do with information reliability at all. In other words, the choice between internal and external control is probably much more complex than is depicted in this study. Finally, care should be taken in generalising these results to other markets since different markets are likely to have considerably different institutional attributes than the municipal market. Future research needs to explore more carefully the differential demand for internal and external control using other types of organisations and other control mechanisms. Together, these limitations provide strong motivation for continued research in this area.

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Earnings management of distressed firms during debt renegotiation

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Abstract—Empirical evidence on earnings management by financially distressed firms is very limited. This study examines discretionary accruals in distressed firms that have undertaken debt contract renegotiation subsequent to debt covenant violation with a view to determining whether managers adopt income-decreasing accruals during debt renegotiation. Using four established models for detecting discretionary accruals during the recent financial crisis in Malaysia, we find evidence that distressed firms manipulate earnings downward. The results show that the magnitude of discretionary accruals is statistically significantly negative during the year surrounding renegotiations with lenders, and that these accruals are significantly more negative than those of a control sample of firms which have not undertaken debt renegotiation during the same period but experienced similar financial performance. The results are robust after controlling for changes in top management, audit qualifications, audit firm size, as well as traditional measures such as firm size, performance, liquidity and leverage.

1. Introduction

Earnings management is an important issue in financial reporting. Prior studies show that managers choose income-increasing accounting policies to reduce the probability of debt covenant violations and to improve the firm's bargaining power during debt negotiation even if the default cannot be avoided by manipulation of earnings (e.g. DeFond and Jiambalvo, 1994; Sweeney, 1994).

However, studies using samples of financially distressed firms suggest that different incentives affect accounting choices in those firms. For example, DeAngelo et al. (1994) examine the accounting choices of NYSE listed firms with persistent losses and dividend reductions. They find that managers of these firms adopt income-decreasing accounting choices even though dividends are under pressure due to negotiation of private debt agreements. This is evident from the large negative accruals in the first year of the dividend cut. Further, DeAngelo et al. (1994) find that 87% of their sample firms renegotiated contracts with labour unions or lenders and quite a number had changes at the executive level during the dividends reduction year. Peltier-Rivest (1999) selects 127 troubled firms that reduce dividends due to operating losses and finds that these firms adopt income-decreasing accounting policies. Consistent with prior studies such as Murphy and Zimmerman (1993) and Pourciau (1993), Peltier-Rivest (1999) attributes income-decreasing accounting choices to the changes in senior management.

Smith et al. (2001) investigate this issue further by categorising firms as failed and non-failed. They predict that managers of distressed firms that subsequently failed would adopt accounting choices to reflect the underlying economic performance of the firm (on average income-decreasing) due to the high ex-post settling costs. However, the results do not support this economic intuition. In a recent study of financial distressed firms in the US, Jaggi and Lee (2002) find that managers use income increasing discretionary accruals if they are able to obtain waivers from lenders for the violation of debt covenants, but use income decreasing discretionary accruals if debt restructuring takes place or debts are renegotiated because waivers are denied. Based on these results, they suggest that the extent of financial distress determines the direction of discretionary accruals.

During the economic crisis, several firms in Malaysia defaulted on their debt repayments and had to undertake debt restructuring with their lenders. We extend this line of research by examining the extent of earnings management of those financially distressed publicly listed firms in

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Malaysia that have undertaken negotiation with their lenders either through government supervision or without government supervision. We argue that financially distressed firms seeking debt restructuring are more likely to adopt income-reducing accruals than those firms that have not undertaken debt restructuring. Unlike prior studies (except for Jaggi and Lee, 2002) that focused on technical violation using samples of both healthy and distressed firms, we provide insights into accounting choices of distressed firms during debt contract renegotiation following actual default. To this end, our study makes a significant contribution towards enhancing our understanding of earnings management by distressed firms. Our study also provides evidence about the direction of accruals[1] that are managed, so that market participants can take this into account when making decisions.

The issue of earnings management during credit renegotiation is particularly important in emerging countries such as Malaysia, where financial statement users are less likely to be able to see through the manipulated earnings due to a lack of technical knowledge and the lack of a sophisticated capital market. Healy and Wahlen (1999) note that even sophisticated analysts may not fully detect earnings management when financial statements do not clearly disclose the balances and activity of the managed items. Further, in Malaysia the unique features of business enterprises, i.e., heavy debt burden, less transparency and governance, closely held ownership structure (Claessens et al., 2000), coupled with a number of publicly held and politically supported firms (Johnson and Mitton, 2003; Gomez and Jomo, 1997), offer different levels of contracting and political costs, which may not be found in the developed western countries.

We computed abnormal accruals (discretionary accruals) using four established models to detect earnings management. We find our sample of defaulted firms that renegotiated debt with their lenders either through Corporate Debt Restructuring Committee (CDRC) assistance or directly, exhibit statistically significant negative discretionary accruals during the negotiation periods. We control for the firm's financial performance and find that discretionary accruals are still significantly negative compared with those of a control sample of poorly performing firms that have not defaulted on debt repayment. Our results are robust after controlling for senior management changes, auditor qualifications, audit firm size, and traditional political and contracting proxies in a multivariate regression model.

This paper is divided into seven sections. After the introduction, Section 2 presents background information on the Malaysian financial crisis and the establishment of special institutions for debt restructuring. Hypotheses are developed in Section 3, followed by discussions on sample selection and data collection in Section 4. Research method and empirical procedures are discussed in Section 5, and empirical findings and discussions are presented in Section 6. Finally, the summary and conclusions of the study are contained in Section 7.

2. Institutional background: financial crisis and corporate debt during the economic crisis in Malaysia

Malaysia had an impressive record of economic performance during the 1980s. However, the country's economy began to suffer following the Asian financial crisis from mid 1997. The immediate impact was evident from a sharp decline in the value of Malaysian currency (Ringgit), gross national product and the stock market. During the crisis, most corporations suffered a decline in output and profitability. Total after tax earnings of listed non-financial firms declined from RM25.5bn in 1996 to RM22.5bn in 1997 and RM11.41bn in 1998, despite an increase in the number of firms listed on the Kuala Lumpur Stock Exchange (KLSE) (Bank Negara Malaysia, 2000).[2] In response to an increasing number of firms facing financial difficulty, the government formed two institutions in 1998: (1) Corporate Debt Restructuring Committee (CDRC) to facilitate debt and corporate restructuring; and (2) Pengurusan Danaharta Nasional Berhad (Danaharta) to purchase non-performing loans (NPLs)[3] from the banking sector. Following the purchase of NPLs, Danaharta appoints an administrator for the defaulted firm to help overcome its operational difficulties and to develop a proposal for long-term viability. As both CDRC and Danaharta have a minimum limit for total borrowing and defaulted amount, most small firms did not meet the criteria and hence undertook debt restructuring directly with their lenders.

Defaulted firms, which are not eligible to receive assistance from the CDRC or Danaharta, can also utilise an option to restructure their debts in accordance with provisions in Section 176 of the Companies Act, 1965. Section 176(10) enables a company to obtain a restraining order from further proceedings by the creditors to winding up the firm. The order then allows the distressed company to reach a compromise or an alternative arrangement with the lenders to restructure for approval of the scheme by the Court.[4]

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[1] Following conventional practice, we use the terms 'abnormal accruals', 'discretionary accruals', 'managed accruals' interchangeably.

[2] There were 621 firms listed on the KLSE in 1996, 708 firms in 1997 and 736 firms in 1998.

[3] Non-performing loans mean loans which are in arrear for over six months as defined by the International Monetary Fund (IMF). Refer to http://dsbb.imf.org/country/mys/aabmeth.htm for further information.

3. Hypotheses development

The political costs hypothesis suggests that firms have incentives to decrease reported earnings to reduce costs that may be imposed by external parties (Watts and Zimmerman, 1986). However, Jones (1991) argues that external parties do not necessarily impose costs on the firms but may offer benefits. Jones (1991), Lim and Matolcsy (1999) and Navissi (1999) provide evidence of the reduction of reported earnings in order to get favourable consideration from government bodies.

For troubled firms, DeAngelo et al. (1994) argue that corporate managers adopt income-decreasing accounting choices to give a signal that they are willing to acknowledge the problems and they are serious about streamlining the firm's operations. However, Bergman and Callen (1991), Noe and Wang (2000) and Jaggi and Lee (2002) suggest that managers of a distressed firm during debt renegotiation are focused on convincing creditors to extract concessions so that the firm can overcome its financial difficulties that would derive benefits to both parties.[5] Financial misrepresentation during debt restructuring occurs because creditors suffer from an asymmetric information problem (Giammarino, 1989; Holland, 1994).

Although bank lenders have the ability to liquidate assets pledged as security and may refuse to accept suggested concessions in the presence of other public debt-holders, the incentive to liquidate security is reduced when the economy is in recession because it is likely that the realisation value is very low (Shleifer and Vishny, 1992). Asquith et al., (1994) provide evidence that secured bank lenders usually waive covenants, reschedule principal or interest payments, reduce interest rates or provide additional financing rather than tightening the covenants through a decline in lines of credit or an increase in collateral during economic recession.

Thus, to obtain concessions from creditors, managers must make a credible case that current economic conditions pose a serious threat to the firm's viability. This manipulation will not affect creditors' decision not to wind up a distressed firm since they already believe that the firm has a good prospect of recovery.[6] Thus, managers of borrowing firms are expected to engage in significant income-reducing accruals during the negotiation period.

As mentioned earlier, the financial crisis in Malaysia can be viewed as a debt crisis resulting from a slump in corporate performance and massive outflow of capital due to uncertainty. During the crisis, the Malaysian government became involved in restructuring the economy by providing protection, financial support and political patronage to business enterprises with a view to improving corporate performance and to avoiding massive unemployment. Drawing on prior research, we suggest that companies with any likelihood of obtaining government support are likely to reduce their reported earnings in order to extract maximum concessions in the form of favourable refinancing terms and protection. Those companies who are not eligible for government support and have undertaken debt restructuring directly with their lenders are also expected to reduce earnings since they know that the economy is in recession and the lenders would not impose severe penalties due to the lower realisable value of the collaterals. Even if the lenders can detect earnings manipulation, this may be condoned since successful renegotiation would benefit both lenders and borrowers when the borrowers survive and improve performance. The reduction of reported earnings may also be efficient as this signals to the market that managers are serious about streamlining the operations with a view to improving performance since they are more concerned with retaining job and reputation in the sluggish employment market (Johl et al., 2003).

Hence, the hypothesis stated in alternative form is proposed as:

H_1: *Firms under debt contract renegotiation adopt income-decreasing discretionary accruals during the negotiation periods.*

Further, during the economic crisis, companies that are not severely affected may also engage in income reducing activity, but to a lesser extent, in order to report higher profit subsequently and to put blame on the economic downturn (Johl et al., 2003). To examine whether the discretionary accruals in debt renegotiating firms are not entirely driven by financial performance, we compare the discretionary accruals of other poorly performing firms which have also experienced similar operating performance during the crisis but have not restructured debts. Consequently, we propose the following hypothesis.

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[4] Under Section 176 alternative, a restructuring scheme has to be approved by either 75% in value or a simple majority in number of each class of creditors before a restraining order is sought from the court.

[5] Gilson (1990) provides evidence that normally bank lenders impose more restrictive debt covenants to protect their investments in financially troubled firms. This argument is true for a non-defaulter firm, but for firms under debt renegotiation, creditors are expected to give concessions so that the distressed firms can resolve the financial problems and repay the debt.

[6] One version of the Coase Theorem argues that debt renegotiation will take place if an indebted firm has a good prospect and financial distress is only temporary (Haugen and Senbet, 1978; Jensen, 1989). This argument is appropriate when financial distress is caused by economic wide recession.

H_2: *Discretionary accruals for firms under debt contract renegotiation are significantly more negative than discretionary accruals for other poorly performing firms during the same periods.*

4. Sample selections and data collections

In order to test the prediction of accounting choices during the debt renegotiation process, listed firms that have undergone debt renegotiation with lenders in 1998 and 1999 were selected from the KLSE (we call these 'debt renegotiating' firms). Firms' announcements from the KLSE website were searched using "CDRC", "debt", "restructuring", "Section 176", "renegotiations", "rescheduling", "contract revisions" and their variation terms. We analysed each announcement to distinguish between internal restructuring and external restructuring activities so that only firms that have undertaken external restructuring are included in the initial sample. However, we suspect that there could be firms with both internal restructuring and debt restructuring still in the experimental sample since some firms have not announced internal restructuring separately.

Financial statements for seven years (1994–2000) were collected from the Kuala Lumpur Stock Exchange Research Information Systems (KLSE-RIS) database.[7] Since the database is formatted, we obtained copies of annual reports of the 'debt renegotiating' and control firms from the KLSE library, to get additional information to estimate discretionary accruals and to measure the explanatory variables for the regression model.

The debt renegotiating firms comprised all firms, from all industrial classifications, which defaulted on their debt payments and undertook debt restructuring in 1998 and 1999. Since investigation into the performance of these firms reveals that these firms experience two years of negative earnings prior to default, we selected a control sample of firms listed on the KLSE that have experienced similar operating performance with at least two consecutive years of negative earnings. These control firms have not failed in debt repayment and have not renegotiated their debts but are matched based on the negotiation year for the test sample.[8] Since results in prior research indicate that firm performance has a systematic relationship with accruals (Dechow et al., 1995), we emphasised on the financial performance of control firms, such as earnings and operating cash flows. We acknowledge that these control sample firms are not exactly matched-paired, but we selected these firms from the same industry depending on the availability of data on the KLSE.

Following Young (1999), we exclude financial institutions, banks and firms in regulated industries (for example, utilities) from the sample because the accruals in these firms differ substantially from other firms. These firms are also expected to face potentially conflicting regulatory incentives to manage earnings. We identified 36 firms that restructured debts under the supervision of the CDRC (hereinafter called CDRC firms), 58 firms that restructured debts through direct negotiations (Other Debt) and 59 other poorly performing firms with at least two consecutive years of negative earnings (Control) (Panel A, Table 1). For firms under the CDRC supervision, 19 (17) firms began renegotiations with lenders in 1998 (1999) financial year. There are 27 (31) Other Debt firms that began renegotiations with lenders in 1998 (1999). The 59 control firms constitute the population of firms that meet the criteria set earlier. The final sample consists of 153 firms from five industries.

We exclude Danaharta-assisted firms (13 firms) from the analysis because Danaharta purchases non-performing loans from the lending institutions and appoints an administrator to operate the firm. This system relieves the firms from debts owing to the banks/financial institutions, and substitute Danaharta as the new creditor. The elimination of information asymmetry between the firms and lenders gives rise to a different set of earnings management incentives that are beyond the scope of our study.[9]

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[7] This database only has key financial performance measures and does not contain full financial statements. The disc is available for purchase from the 'KLSE Shoppe' by accessing website: http://www.klse.com.my/website/resource/pubshop.htm. In addition to company financial statements, this database also contains information about company profile, subsidiaries, properties, current share price, directors in office, directors shareholding, ratio analysis, and past announcements.

[8] DeAngelo et al. (1994) and Peltier-Rivest (1999) define distressed firms as firms that experience a decline in dividend, and have at least three consecutive years of negative earnings. Using these criteria would reduce the control sample to less than 10 firms.

[9] For example, a newly appointed administrator may act in the same way as newly appointed managers who are driven by motivations to increase future compensation. However, the administrator's compensation may also be determined by successful selection of 'white knight' firm to take over the managed firm, or in worse case, liquidations of the assets that can repay Danaharta's initial investment (minus associated costs). The motivation of 'white knight' bidders complicates the issues further. Results in Carrol et al. (1999) indicate that shareholders of 'white knight' bidders react negatively to takeover bids. It is also shown that 'white knights' tend to invest in negative net present value projects rather than paying dividends to shareholders, and overprice the targets. Examining the consequences of these motives requires more developmental work as well as more detailed data.

Table 1
Sample selection and profile

Panel A: Number of firms according to groups

	# Firms
1. Firms under Corporate Debt Restructuring Committee	36
2. Firm restructure debt without government supervision	58
3. Firms that have at least two consecutive years of negative earnings (control)	59
Total	**153**

Panel B: Sample firms by industry and groups

	CDRC	*Other Debt*	*Control*	*Total*
Properties Development & Construction	13	19	11	43
Consumer Products	3	9	11	23
Industrial Products & Technology	13	13	14	40
Mining & Plantation	0	7	3	10
Trading and Services	7	10	20	37
Total	**36**	**58**	**59**	**153**

($\chi^2 = 8.163$; df 8, $p=0.086$)

Panel B of Table 1 compares sample groups based on industrial classifications. The property development and construction industry has the highest number of distressed firms (43 firms), followed by the industrial products and technology industry (40 firms). In the trading and services category, slightly higher than 50% of firms fall under the *Control* sub-sample. Table 1 (Panel B) shows that the distribution of control firms is not significantly different at the conventional 5% level from that of the test sample across industry classification ($\chi^2 = 8.163$; $p=0.086$).

Since sample firms vary in their financial year-end, we followed a procedure described in Peasnell et al. (2000) to align their fiscal years. A fiscal year includes all firms that have their year-ends falling between 1 June in the current year and 31 May in the following year. We assume debt renegotiation to begin on the date it is mentioned in the KLSE announcement that CDRC agreed to assist the firm, or when the firm successfully obtained Section 176 protection from creditors action, unless an earlier date is determinable from other source documents. Consistent with Gilson (1990), we further assume that efforts to restructure begin immediately because creditors often demand immediate payments of their interest and principal. The first year of renegotiation is labelled year 0. The control firms are aligned based on the renegotiation financial year, which took place in 1998 and 1999.

5. Research method

Most of the recent earnings management studies use the Jones model (Jones, 1991) or the modified Jones model (Dechow et al., 1995). Therefore, two of our four discretionary accruals are estimated by employing the Jones and the modified Jones models. To estimate discretionary accruals, we need to compute total accruals (*TACF*), which is measured as the difference between income before tax and extraordinary items (*EARN*) and operating cash flows (*OCF*):

$$TACF_{it} = EARN_{it} - OCF_{it} \qquad (1)$$

This is the cash flows approach to measuring total accruals. Another measure of total accruals popularly used in the literature is the balance sheet approach (Healy, 1985). Hribar and Collins (2002) argue that the balance sheet approach introduces positive bias when mergers and acquisitions occur, and negative bias when discontinued operations occur. Since the distressed firms are expected to engage in structural changes, we only use the cash flows approach to measure total accruals.

We use the cross-sectional version of the Jones (1991) model as suggested by DeFond and Jiambalvo (1994). Recent evidence suggests that the cross-sectional Jones and the modified Jones models have more power in detecting discretionary accruals (Jeter and Shivakumar, 1999; Bartov et al., 2001):[10]

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[10] The original Jones model (Jones, 1991) requires tests on earnings management to have at least 10 time series observations for each firm for reliable results. Many studies use the cross-sectional version (e.g. DeFond and Jiambalvo, 1994; Rees et al., 1996) because of survivorship bias inherent in the original time-series version. In addition, there could be a question regarding stationarity of the data during the crisis period if the time-series model is used.

$$TACF_{it}/A_{it-1} = \alpha_1(1/A_{it-1}) + \alpha_2(\Delta REV_{it}/A_{it-1}) + \alpha_3(PPE_{it}/A_{it-1}) + \upsilon_{it} \qquad (2)$$

where *TACF* is total accruals, *ΔREV* is changes in total revenue, *PPE* is the net property, plant and equipment, and υ_{it} is the residuals. Following Culvenor et al. (1999), we use end of the period *PPE* level since the gross value of *PPE* is not available from the database.[11]

All variables in Equation (2) are scaled by lagged total assets (A_{it-1}) to reduce heteroscedasticity. At the first step (which is called the parameter fitting process), the above equation is estimated cross-sectionally for each industry-year portfolio utilising all firms (other than 'debt renegotiating' firms), based on the KLSE industrial classifications (Rees et al., 1996; Kasznik, 1999).[12]

The discretionary accruals (*DAC*) are determined as the prediction errors (υ_{it}), that are the difference between the predicted accruals using the parameter estimates from the first step, and reported accruals for each test sample firm-year. Specifically, discretionary accruals of the cross-sectional Jones (1991) model are the prediction errors of the total accrual model, where $\hat{a}1$, $\hat{a}2$, $\hat{a}3$ are parameter estimates of α_1, α_2, α_3 in (2):

$$\upsilon_{it} = TACF_{it}/A_{it-1} - [\hat{a}_1(1/A_{it-1}) + \hat{a}_2(\Delta REV_{it}/A_{it-1}) + \hat{a}_3(PPE_{it}/A_{it-1})] \qquad (3)$$

DAC from the cross-sectional modified Jones model are determined as follows, using the same parameter estimates as obtained in the first process (2):

$$\upsilon_{it} = TACF_{it}/A_{it-1} - [\hat{a}_1\,(1/A_{it-1}) + \hat{a}_2\,(\Delta REV_{it} - \Delta RECit)/A_{it-1} + \hat{a}_3\,(PPE_{it}/A_{it-1})] \qquad (4)$$

Since changes in the depreciation method and estimates are disclosed in financial reports, managers have less incentives to use this item to manage earnings. Therefore, we also examine the working capital model as used in DeFond and Jiambalvo (1994) that excludes depreciation. We use working capital movements from the statement of cash flows (Hribar and Collins, 2002). This measure eliminates non-operating changes in the current accounts shown on the balance sheet that may relate to mergers, acquisitions, divestments or discontinued operations. The estimation model is similar to the original and modified Jones models except for the *PPE* variable. We exclude *PPE* from the equation because working capital accruals do not include depreciation. *DAC* estimation procedures are similar to the procedures used for total accruals. We use four discretionary accruals models to overcome the weaknesses in measuring the discretionary accruals in individual models and enhance the validity of our findings.

6. Empirical results

6.1. Firm performance

We use revenue (*REV*) scaled by end-of-year book value of total assets, return on assets (*ROA*) (earnings before extra-ordinary items and tax scaled by end of year book value of total assets), and operating cash flows (*OCF*) (scaled by end of year book value of total assets) to measure firm performance. Table 2 (Panel A) shows, on average, that *REV* in *CDRC* firms reduced significantly each year from year –3 (mean= 0.621) to +1 (mean= 0.344), that is, a decrease of 45.2% over the years. This pattern of reduction in *REV* is also exhibited in the *Other Debt* category. The magnitude of loss in *REV* over these years is 20.1%, a decrease from 0.542 to 0.433, which is similar for *ROA*. However, *OCF* increased in both categories of firms, showing an improvement in cash management prior to and during the debt negotiation periods. Further analysis shows that several of these firms sold assets and accelerated collections in order to improve their liquidity.

Table 2 also exhibits that distressed firms approaching default reduce their reliance on equity financing. For *CDRC* firms, the average equity-to-total assets ratio (*SEQTA*) reduced from 0.354 in year –3 to 0.185 in year –1. Negative earnings further reduced the ratio to the extent that *CDRC* firms experience, on average, negative equity-to-total assets ratios in years 0 and +1. A similar pattern of *SEQTA* is observed in *Other Debt* firms. This is consistent with the claim that part of the crisis is explained by weak business fundamentals before the crisis (Iskander et al., 1999).

The Table also indicates that firms shift their reliance from long (*LTDTA*) to short term financing (*STDTA*). This shift, in part, shows that a funding mismatch problem (when firms use short-term loans for long-term project financing) exists in both *CDRC* and *Other Debt* firms that lead them to default.[13]

Table 3 shows that debt renegotiating firms are not significantly different from the control sample at the conventional 5% significance level across

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[11] Culvenor et al. (1999) find the difference in R^2 statistics of accruals models employing gross PPE and net PPE, excluding non-depreciable assets and including all amortisable assets, is not significant, as measured by the Vuong test (1989).

[12] This procedure eliminates industry-specific effects where the accruals behaviour and the impact of economic recession are different between industries. The year portfolio mitigates: (1) economic-wide effects that affect all firms in a particular year, and (2) non-stationarity of data in the time-series version of the original model during the recession period.

[13] Although the figures reported in the table are based on different number of cases, i.e., 90 firms in year –3 and 94 firms in other years, the figures do not change much if we exclude four firms in other years.

Table 2

Operating performance, equity and leverage ratios from year –3 through year +1 of debt renegotiating firms

	Institutions[b]	–3	–2	–1	0	+1
Panel A: Firm Performance						
REV[a]						
Mean (median)	CDRC	0.621	0.528	0.425	0.584	0.344
		(0.519)	(0.463)	(0.395)	(0.335)	(0.249)
	Other Debt	0.542	0.525	0.495	0.474	0.433
		(0.520)	(0.462)	(0.349)	(0.343)	(0.337)
ROA[a]						
Mean (median)	CDRC	0.048	0.024	–0.108	–0.637	–0.281
		(0.049)	(0.036)	(–0.050)	(–0.130)	(–0.117)
	Other Debt	0.047	–0.090	–0.337	–0.491	–0.228
		(0.049)	(0.016)	(–0.125)	(–0.204)	(–0.128)
OCF[a]						
Mean (median)	CDRC	0.183	–0.033	0.018	0.205	–0.048
		(0.006)	(–0.002)	(0.007)	(0.029)	(0.033)
	Other Debt	–0.020	–0.022	0.087	0.118	–0.106
		(–0.007)	(–0.022)	(0.013)	(0.047)	(–0.002)
Panel B: Firm Solvency						
SEQTA[a]						
Mean (median)	CDRC	0.354	0.295	0.185	–0.530	–0.993
		(0.387)	(0.329)	(0.190)	(0.064)	(0.010)
	Other Debt	0.397	0.290	–0.004	–0.473	–0.831
		(0.374)	(0.297)	(0.166)	(0.090)	(–0.023)
STDTA[a]						
Mean (median)	CDRC	0.280	0.282	0.330	0.907	1.789
		(0.246)	(0.281)	(0.308)	(0.440)	(0.492)
	Other Debt	0.200	0.251	0.425	0.665	0.693
		(0.187)	(0.240)	(0.377)	(0.513)	(0.523)
LTDTA[a]						
Mean (median)	CDRC	0.089	0.126	0.164	0.149	0.158
		(0.072)	(0.100)	(0.121)	(0.081)	(0.024)
	Other Debt	0.124	0.141	0.117	0.096	0.094
		(0.075)	(0.088)	(0.061)	(0.040)	(0.005)

[a] All statistics shown are based on 94 firms except for year –3 (90 firms). *REVENUE* is total revenues scaled by total assets, *ROA* denotes return-on-assets measured by operating profit before tax divided by total assets, *OCF* is operating cash flows scaled by total assets, *SEQ/TA* denotes total shareholders equity divided by total assets, *STD/TA* is short-term debt divided by total assets, and *LTD/TA* is long-term debt divided by total assets.
[b] *CDRC* denotes firms that are under the Corporate Debt Restructuring Committee, *Other Debt* denotes sample firms that have debt restructuring outside the *CDRC* and Danaharta during the sample period.

several performance measures, namely current period's return on assets (*ROA*) (Kothari et al., 2001), one-year change in return on assets (*ChgROA*), operating cash flows (*OCF*), one-year change in operating cash flows (*ChgOCF*) (Kasznik, 1999), and firm size (total assets and revenue). However, Table 3 shows that the two groups are significantly ($p<0.01$) different with regard to liquidity (measured by both current ratio and quick ratio) and changes in revenue (*ChgREV*).

We proceed with the parameter fitting process using all available firms' data. As all independent variables exhibit a high standard deviation and a wide difference between mean and median values every year, particularly in 1999, we deleted observations with DFFITS[14] of more than two (following Jeter and Shivakumar, 1999) to obtain reliable and

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[14] The *Dffits statistic* is a scaled measure of the change in the predicted value for the *i*th observation. For linear models,

$$F_i = \frac{\hat{x}_i - \hat{x}_{(i)}}{s_{(i)}\sqrt{h_i}}$$

where $\hat{x}(i)$ is the *i*th value predicted without using the ith observation. Large absolute values of F_i indicate influential observations. A general cut off value is two.

Table 3
Comparison of operating performance, firm size, and liquidity between the debt renegotiating and control firms in renegotiating year

Variables[a]	*Debt renegotiating Mean (Median)*	*Control Mean (Median)*	*t-stat (p-value)*
ROA_t	–0.141	–0.146	0.129
	(–0.076)	(–0.075)	(0.898)
$ChgROA_t$	0.045	0.043	0.049
	(0.018)	(0.017)	(0.961)
OCF_t	0.055	0.056	–0.084
	(0.035)	(0.047)	(0.933)
$ChgOCF_t$	0.009	0.011	–0.019
	(0.018)	(0.033)	(0.984)
REV_t	0.518	0.590	–0.947
	(0.337)	(0.418)	(0.345)
$ChgREV_t$	–0.218	–0.076	–2.528
	(–0.248)	(–0.074)	(0.012)
TASS (RM Million)	1.121	0.815	0.912
	(2.643)	(2.092)	(0.363)
CR_t	0.553	1.403	–3.408
	(0.513)	(0.748)	(0.001)
QR_t	0.394	1.073	–2.86
	(0.316)	(0.511)	(0.005)

[a] *ROA* is return on total assets, *ChgROA* denotes changes in return on total assets, *OCF* is operating cash flows and *ChgOCF* is changes in operating cash flows, and *REV* is total revenues, $ChgREV_t$, is changes in revenue from the previous year. *TASS* is the book value of total assets during the negotiation period, CR_t is current assets divided by current liabilities, QR_t is quick ratio is current assets less inventories divided by current liabilities.

[b] Significance level is based on a two-tailed test.

population representative parameter estimates. We also require at least 10 observations to be in the estimation sample. There are a total of 3,514 firm-years employed in the parameter fitting process, with the highest number of observations in year 2000 (641 firms).

As estimations are made according to industry-year portfolios, Z-statistics are computed to aggregate t-statistics across all industry-year portfolios.[15] The results (not tabulated) show that the estimates of the changes in revenue variable ($\Delta REV_{it}/A_{it-1}$) are generally positive in both the total accrual and working capital accrual models. These results are consistent with prior studies such as DeFond and Jiambalvo (1994), although Jones (1991) makes no predictions about the sign of the coefficient.[16]

The coefficients on property, plant and equipment (PPE_{it}/A_{it-1}) are not significant (Z-statistic is –1.023). The insignificance of *PPE* can be explained by the fact that many poorly performing firms in the estimation sample engage in asset sales (to increase cash flows for debt repayments) and write-downs during economic recession (Francis et al., 1996). This may also alter the relation between the depreciation expense and the book value of the assets. A closer examination reveals that a great majority of the firms change their estimates of provisions during the negotiation periods, in addition to asset writedowns and sales. Overall, the average adjusted R^2 for the total accrual model is 0.324, while for the working capital accrual model it is slightly lower (0.208).

The estimated *DAC* derived from the four cross-sectional models described earlier suggest that the distribution is not normal, as evidenced by high skewness and kurtosis (not tabulated). Non-normality in the residuals is expected because the sample is drawn from distressed/poorly perform-

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[15] There are 35 industry-year portfolios (five industries x seven years) with mean observation of 101 firms. Z statistics are computed by aggregating the *t*-statistics across *N* portfolios using the following formula (*t* is *t*-statistic for portfolio j, *k* is the degree of freedom for the respective *t*-statistic in the portfolio *j*). The Z-statistic is assumed to have an asymptotic normal distribution.

$$Z_1=(1/\sqrt{T})\sum_{j=1}^{T}(t_j/\sqrt{k_j/(k_{j-2})}$$

[16] The sign of revenues can be positive or negative depending on the net effect of changes in working capital accounts such as accounts receivables, inventory (both positively correlated with accruals) and accounts payable (negatively correlated with accruals).

ing firms. However, we find a few influential outliers by plotting of the residuals. Thus, we winsorise the *DAC* to the point equivalent to the top and bottom 1% level of the ranked residuals (Kothari et al., 2002). Winsorising does not eliminate outliers, but limits their effects. After winsorising, the highest kurtosis for *DAC* of 0.474 is found to be in Model 4. The results reported in this study are based on winsorised *DAC*, as reported in Table 4.

6.2. *Discretionary accruals during debt renegotiation*

To investigate the behaviour of debt renegotiating firms, we obtained the *DAC* three years prior to and one year following the negotiation years, where 0 denotes the beginning of renegotiation between the borrowing firms and their lenders. The results of the computed *DAC* from the four accruals models are presented in Table 4.

The Table shows that *DAC* are positive in three and two years preceding the renegotiation but are negative in one year leading up to the renegotiation for all four models. For example, in Model 1 the mean *DAC* is 0.020 and 0.023 in years -3 and -2 respectively but the mean *DAC* is –0.135 in year –1, which is significant ($p<0.01$). The median values also indicate a similar trend. This accruals behaviour may be due to upward earnings management in firms approaching violation of their debt contracts (see Rosner, 2003 for the reversal of accruals in bankrupt firms). Therefore, it can be argued that the negative *DAC* in year –1 may be due to the reversal of past income increasing accruals or due to firms' poor performance. The negative *DAC* in year –1 is also consistent with the 'anticipation' explanation of Shivakumar (2000), who finds that accruals change due to issuers' anticipation of the market reaction at seasoned equity offer announcements.

Table 4 shows that the mean (median) *DAC* of debt restructuring firms are –0.219 (–0.139), –0.235 (–0.173), –0.121 (–0.086) and –0.134 (–0.094) for models 1, 2, 3 and 4 respectively during the year 0 (negotiation period), and all are significantly negative ($p<0.01$) and consistent with Jaggi and Lee (2002). However, the total accruals models show a higher level of negative *DAC*, compared with the working capital models, suggesting that data in our study are sensitive to model selection. The same trend is observed in year 1 (post negotiation), with negative and significant ($p<0.01$) *DAC* across all the four models, but the magnitude is lower compared with that of the negotiation year. The magnitude of the *DAC* is higher than that obtained by Johl et al. (2003), who reported an average *DAC* between –0.144 and –0.187 in Malaysia using the modified Jones model. However, they used a sample of 596 healthy and poorly performing firm-year observations during 1994–1999. The above results support our hypothesis 1, suggesting that the debt restructuring firms use income-decreasing accruals during renegotiations with their lenders.

The fact that we observe persistently large negative accruals surrounding the negotiation periods raises concern about the reasonableness of the magnitude of earnings management. DeAngelo et al. (1994) suggest that such large abnormal accruals may be related to sample firms' ongoing difficulties.[17] It is also possible that the magnitude of negative discretionary accruals has been accentuated due to the reversal of some past income increasing discretionary accruals in the two and three years prior to debt defaults.

Kasznik (1999) finds that the estimated abnormal accruals are highly correlated with financial performance when firms experience financial distress. Since our sample consists of distressed and poorly performing firms during an economic downturn, we estimate all models by including operating cash flows to mitigate the concern that firm performance is correlated with *DAC* (Kasznik, 1999). We find no material difference in results presented in Table 4.[18]

To investigate further whether negative *DAC* during the debt renegotiation period are not misleadingly interpreted as discretionary when it is actually correlated with performance, we compare the *DAC* between 'debt renegotiating' (test) and other poorly performing firms (control).

Table 5 shows the mean and median *DAC* in the two groups. In year 0, the mean (median) *DAC* for the control group is –0.139 (–0.103), –0.137 (–0.103), –0.065 (–0.039) and –0.071 (–0.043) in models 1, 2 3 and 4 respectively. Parametric t-tests and non-parametric Mann-Whitney U tests suggest that in year 0, all models have significantly ($p<0.01$) more negative *DAC* in the debt renegotiating firms than those of the control firms. In year +1, the magnitude of *DAC* has reduced but remains negative and is consistent with the trend observed for the debt renegotiating firms. However, the difference between the two groups is only significant ($p<0.05$) for working capital accrual models. These results support our hypothesis 2 that debt renegotiating firms have greater negative *DAC* during negotiations than those of the control firms.

6.3. *Multivariate analysis*

While using a sample of other poorly performing firms control for performance related negative accruals, there are other confounding factors

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[17] DeAngelo et al. (1994) report abnormal accruals of about 15% of lagged shareholders' equity during the year of dividend reduction by 76 distressed firms. Note that our *DAC* are expressed as a ratio of lagged total assets.

[18] Detailed results are available from the authors.

Table 4

Mean discretionary accruals in CDRC-assisted and other debt restructured firms ('debt renegotiating' firms) from year –3 through +1 (0 is the year of debt renegotiations)

$$\upsilon_{it} = TACF_{it}/A_{it-1} - [\alpha_1(1/A_{it-1}) + \alpha_2(\Delta REV_{it}/A_{it-1}) + \alpha_3(PPE_{it}/A_{it-1})] \qquad \text{(Model 1)}$$

$$\upsilon_{it} = TACF_{it}/A_{it-1} - [\alpha_1(1/A_{it-1}) + \alpha_2(\Delta REV_{it}/A_{it-1} - \Delta REC_{it}/A_{it-1}) + \alpha_3(PPE_{it}/A_{it-1})] \qquad \text{(Model 2)}$$

$$\upsilon_{it} = WCF_{it}/A_{it-1} - [\alpha_1(1/A_{it-1}) + \alpha_2(\Delta REV_{it}/A_{it-1})] \qquad \text{(Model 3)}$$

$$\upsilon_{it} = WCF_{it}/A_{it-1} - [\alpha_1(1/A_{it-1}) + \alpha_2(\Delta REV_{it}/A_{it-1} - \Delta REC_{it}/A_{it-1})] \qquad \text{(Model 4)}$$

Discretionary accrual Models[a]	–3 n=90	–2 n=94	–1 n=94	0 n=94	+1 n=94
Panel A: Parametric test[b]					
	Mean discretionary accruals (*p-value*)				
υ_{it} Model 1	0.020	0.023	–0.135	–0.219	–0.103
	(0.328)	*(0.278)*	*(0.000)*	*(0.000)*	*(0.000)*
υ_{it} Model 2	0.035	0.035	–0.138	–0.235	–0.106
	(0.105)	*(0.115)*	*(0.000)*	*(0.000)*	*(0.000)*
υ_{it} Model 3	0.049	0.056	–0.038	–0.121	–0.069
	(0.005)	*(0.001)*	*(0.025)*	*(0.000)*	*(0.000)*
υ_{it} Model 4	0.057	0.065	–0.041	–0.134	–0.072
	(0.003)	*(0.001)*	*(0.026)*	*(0.000)*	*(0.000)*
Panel B: Non-parametric test[b]					
	Median discretionary accruals (*p-value*)				
υ_{it} Model 1	0.021	0.023	–0.087	–0.139	–0.069
	(0.132)	*(0.178)*	*(0.000)*	*(0.000)*	*(0.000)*
υ_{it} Model 2	0.024	0.026	–0.082	–0.173	–0.072
	(0.024)	*(0.072)*	*(0.000)*	*(0.000)*	*(0.000)*
υ_{it} Model 3	0.032	0.027	–0.028	–0.086	–0.058
	(0.002)	*(0.002)*	*(0.018)*	*(0.000)*	*(0.000)*
υ_{it} Model 4	0.043	0.033	–0.030	–0.094	–0.055
	(0.001)	*(0.000)*	*(0.015)*	*(0.000)*	*(0.000)*

[a] Model 1 is a total accrual cross-sectional Jones model, with total accruals measured using the cash flows approach (Operating Cash Flows – Profit before tax and extraordinary items), Model 2 is a total accrual cross-sectional modified Jones model, Model 3 is a working capital accrual model (working capital accruals is measured as changes in working capital accounts found in the operating section of the statement of cash flows) when it is assumed that all revenues are not managed, and Model 4 is a working capital accrual model when it is assumed that only cash revenues are not managed.

[b] Parametric t-test *p*-value is two-tailed. Non-parametric Wilcoxon test p-value is two-tailed.

that might influence managerial incentives. Consequently, we undertake multivariate tests to control for selected firm specific factors that are found to be correlated with accounting choices in prior research. These factors are audit qualifications (DeFond and Jiambalvo, 1994), management changes (Elliot and Shaw, 1988; Pourciau, 1993), firm performance levels (Kasznik, 1999), leverage and size (Watts and Zimmerman, 1986; Young, 1998), audit quality (Francis and Krishnan, 1999) and liquidity.

We expect a negative association between auditors' going concern qualifications (*AuditQ*) and negative discretionary accruals observed in distressed firms. For troubled firms in economic recession income-increasing accruals are unlikely since these firms increase write-offs, provisions and choose more conservative revenue and expense recognition policy (DeAngelo et al., 1994; DeFond and Jiambalvo, 1994; Peltier-Rivest, 1999). Auditors take a more cautious approach against any attempt by management to increase earnings and would be hesitant to issue an unqualified report for fear of subsequent litigation if the firm goes bankrupt. A dummy variable for *AuditQ* is used where a one is assigned when the firm received an audit qualification, otherwise zero.

Changes in senior executives (*ChgMgt*) are found to be common in distressed firms (Gilson, 1989; and Mian, 2001).[19] Prior studies find greater

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[19] Warner et al. (1988) and Weisbach (1988) find that the changes in senior management are caused by firms' poor performance.

Table 5
Comparison of mean (median) discretionary accruals in debt renegotiating firms with control firms during negotiation periods

	Year 0				Year +1			
Discretionary accrual model[b]	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Debt renegotiating	–0.219	–0.235	–0.121	–0.134	–0.103	–0.106	–0.069	–0.072
	(–0.139)	(–0.173)	(–0.086)	(–0.094)	(–0.069)	(–0.072)	(–0.058)	(–0.055)
Control	–0.130	–0.137	–0.065	–0.071	–0.080	–0.083	–0.031	–0.033
	(–0.103)	(–0.103)	(–0.039)	(–0.043)	(–0.103)	(–0.101)	(–0.055)	(–0.049)
T-stat	–2.979	–3.241	–3.246	–3.429	–0.753	–0.736	–2.034	–1.963
(p-value)[a]	(0.002)	(0.001)	(0.001)	(0.001)	(0.113)	(0.116)	(0.022)	(0.025)
Z-stat	–2.324	–2.653	–2.825	–3.100	–0.643	–0.642	–2.718	–2.634
(p-value)[a]	(0.010)	(0.004)	(0.003)	(0.001)	(0.250)	(0.251)	(0.004)	(0.004)

[a] One-tailed test of significance of t-test and Mann-Whitney U (non-parametric) test. The number of observations is 94 (117) for 'debt renegotiating' (Control) firms in Models 1 to 4.

[b] Model 1 is a total accrual cross-sectional Jones model with total accruals measured using cash flows approach (Operating Cash Flows – Profit before tax and extraordinary items), Model 2 is a total accrual cross-sectional modified Jones model, Model 3 is a working capital accrual model (working capital is changes in working capital accounts found in the operating section of the statement of cash flows) when it is assumed that all revenues are not managed, and Model 4 is a working capital accrual model when it is assumed that only cash revenues are not managed.

[c] '*Debt re negotiating*' firms comprise firms with CDRC and other firms that restructured debts outside CDRC (*Other Debt*).

frequencies of accounting policy changes (Moore, 1973; LaSalle et al., 1993), assets write-offs (Elliot and Shaw, 1988), and income-decreasing discretionary accruals (Pourciau, 1993) following management changes. This behaviour is consistent with the incentives of the new management. First, the new management can blame the previous management for low performance, and second, it can set a lower achievable benchmark against which future earnings can be compared. Therefore, we predict *ChgMgt* to have a negative relation with *DAC*. We use a dummy one when there is a change in senior management during the negotiation year, otherwise zero.

Firm performance (*Perform*) is predicted to have a positive (less negative) relation with DAC based on prior research (Dechow et al., 1995; Kasznik, 1999). We measure *Perform* as prior period's return on total assets. Prior research (although mixed) finds that managers use income-increasing accounting choices when they are close to violating stated covenants in a debt contract (DeFond and Jiambalvo, 1994; Sweeney, 1994). Leverage can also have a negative association with accruals because firms with high leverage tend to have their contracts (e.g. with trade union or workers) renegotiated (as found in Becker et al., 1998). However, as covenants are already violated for nearly half of the firms under consideration, we expect that negative *DAC* would dominate. Since large firms tend to decrease profits to reduce political costs (Watts and Zimmerman, 1986), *DAC* is expected to be negatively associated with firm size (*Size*). We take the natural logarithm of total assets to measure firm *Size*.

Auditors can also limit the pervasiveness of earnings management in firms since they have access to original documents. However, they cannot completely stop such practice since accounting choices are made within the GAAP boundaries.[20] Nevertheless, audit quality, as indicated by large accounting firms (*Big-5*), can restrain managerial incentives from manipulating accounting choices (Becker et al., 1998; Francis and Krishnan, 1999). Thus, for our sample firms we expect *DAC* to be positively associated with the dummy variable assuming the value of one if the company is audited by a *Big-5* accounting firm. In other words, firms employing *Big-5* accounting firms are predicted to have less negative abnormal accruals than firms employing small accounting firms. Finally, we include the current ratio (*CR*) to control for the effect of liquidity to mitigate the concern that estimated *DAC* is mostly driven by the liquidity crisis, since our renegotiating firms have significantly less liquidity than our control firms. We do not predict any directional association between *CR* and *DAC*.

The multivariate model tests only *DAC* in the first year of negotiation (year 0), which is the principal focus of this paper. The descriptive statistics show that other than the *Lev* variable there is no concern with skewness of the variables. Although, *Lev* shows a wide range, the standard deviation (sd = 2.96) and the histogram do not indicate any major deviation from normality. For other variables, the data show that about two-third of the firms employed *Big-5* audit firms and about 13% of them received audit qualifications. About 45% (94/210) of the firms renegotiated and 25% of all firms had changes in senior management. For the continuous variables, the mean (median) for *Perform*, *Lev*, *Size* and *CR* are –0.251 (–0.072), 1.330 (0.799), 5.434 (5.405) and 0.892 (0.634) respectively. Further, we checked the number of positive and negative *DAC* in both years for the renegotiating firms as well as the control firms to assess whether there are high negative *DAC* values associated with a small number of firms. We find that the number of negative *DAC* for the renegotiating firms is between 78 and 81(more than 82%) and between 88 and 96 (more than 75%) for the control firms across the four models.

Correlation analysis confirms that the *AuditQ* and *Nego* are positively correlated, with the correlation coefficient being 0.202, and significant at 1%. We find that *Perform* is not significantly correlated with *Nego*. However, the correlation between *Size* and *Perform* is significantly positive ($r = 0.253$, $p < 0.01$). This correlation implies that the larger the firm size, the better the performance. Consistent with prior research, large firms are associated with Big-5 audit firms ($r = 0.223$, $p<0.01$). The Pearson correlation between *Perform* and *Lev* is –0.515 ($p<0.01$), indicating firms with higher leverage are poor performers. The correlation coefficient between *Perform* and *Lev* is 0.650 ($p<0.01$), which suggests that multicollinearity could be a problem in the regression estimation. Since the highest Variance Inflation Factor (VIF) of 1.397 associated with *Perform* for winsorised data (Table 6) and of 1.419 associated with *Lev* for normalised data (Table 7) is well below the conservative threshold of 5 (Montgomery and Peck, 1992), multicollieairity will not be a problem in the regression estimation. We find that *CR* is not significantly correlated with any other explanatory variables except for *Nego*, which is negative at –0.230 ($p<0.01$).

The results of the multivariate analysis are presented in Table 6. The intercept is –0.591, –0.606, –0.332 and –0.358 in Models 1, 2, 3 and 4 respectively, and are all significant ($p<0.01$). This suggests that, on average, both debt renegotiating and non-renegotiating firms have employed income-reducing accruals when all other control variables are set to zero.

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[20] Hirst (1994) shows how auditors are sensitive to income-decreasing accruals in management buy-out sample firms. While auditors are also found to increase their procedures on high-risk areas involving material overstatement of earnings consistent with bonus plan hypothesis, they are less sceptical for income-decreasing accruals (understatement of earnings) found in the upper-bound firms.

The coefficient on *AuditQ* is significantly negative ($p<0.01$) and varies between –0.103 in Model 1 to –0.067 in Model 4. The significantly negative association suggests that firms receiving audit qualifications have income decreasing discretionary accruals. In contrast, *ChgMgt* is not significant in any model, suggesting that changes in senior management within the sampled firms have not explained the variation in discretionary accruals activity. This result is not consistent with Peltier-Rivest (1999). The regression coefficient on *Nego* is –0.069, –0.078, –0.046 and –0.052 in Models 1, 2, 3 and 4 respectively, and each is significant ($p<0.01$). This suggests that the rate of change in *DAC* after controlling for the other determinants is between 4.6% in Model 3 and 7.8% in Model 2 due to renegotiation and supports our principal findings reported in Tables 4 and 5 that managers report significantly lower discretionary accruals during debt renegotiation. *Lev* is also significant ($p<0.01$) and negative in all models, which implies that highly levered firms pursue negative *DAC*. To investigate further whether firms who are in default (renegotiating firms) are more inclined to decrease reported earnings the more indebted they are compared to similarly indebted firms that are not in default, we include an interaction variable *Nego*Lev* in the regression equation and rerun the four models. The coefficient on this variable is –0.026, –0.024, –0.016 and –0.016 for Models 1, 2, 3 and 4 respectively, and each is significant ($p<0.05$). This is consistent with the argument that geared firms don't see any benefits of increasing reported earnings when the economy is in recession and particularly for those who have already defaulted and had to restructure their debts.

Perform is not significant in any model. The insignificant coefficient on this variable suggests that the control measures adopted in this study are effective in eliminating confounding results associated with performance. In contrast, *Size* is positively significant, suggesting that large firms employed less negative *DAC* than small firms. This is inconsistent with the political cost hypothesis. To determine whether it is the particular measurement proxy for *Size* that resulted in a positive coefficient, we use the natural logarithm of revenue as an alternative size proxy. Untabulated results reveal the positive coefficient on *Size* remains while other results are qualitatively similar. This contrasting result could be due to the nature of sample firms utilised in this study. To explore further, we subdivide all KLSE firms into positive and negative earnings and find that the positive association between *DAC* and *Size* holds for firms that reported negative earnings and find a negative association for firms that reported positive earnings.[21]

Big-5 is significantly positively ($p<0.05$) related to *DAC* measured in Models 1 to 4, which is consistent with our expectation that companies audited by the *Big-5* audit firms tend to have less negative discretionary accruals compared with other companies whose accounts are audited by non Big-5 audit firms. We find that *CR* is insignificant in all models.

The residuals are normally distributed in all four models as is evident from the Jarque-Bera test, with the lowest value being 1.259 ($p<0.531$) and the highest value being 4.961 ($p<0.084$).[22] All models are significant ($p<0.01$) and have an explanatory power (adjusted R^2) between 22.7% in Model 1 and 25.9% in Model 4.

6.4. *Sensitivity analyses*

To examine the relations without winsorising the data, we employ a normal transformation procedure as suggested by Cooke (1998) to the original *DAC* data. Without transformation, OLS regression assigns high weight to outlying observations, thus estimation is sensitive to the inclusion or exclusion of outliers. Following Young (1998), the Van der Waerden's approach of normal transformation is employed to the dependent variable.[23]

Table 7 confirms the previous results that *Nego* is significant in all models. Comparison of the results indicates that the significance level of all other variables in the transformed regression re-

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[21] Our analysis also reveals that the correlation between *Size* and *DAC* is not affected by performance, leverage or liquidity and also not affected if firms are audited by Big-5 or non-Big-5 audit firms. However, using all available data from year 1990 to year 2001, we find that the correlation between abnormal accruals (measured using working capital model) and *Size* (log of total assets) is significantly negative (Pearson coefficient =–0.066, p=0.000) in firm-years that report positive earnings (4,930 observations). While for firms reporting negative earnings (938 observations), the correlation is positive (Pearson correlation = 0.102, p=0.002). This result indicates that the negative relation between income-increasing discretionary accruals and size of firms only holds for profitable firms. This positive association between *DAC* and *Size* could be due to unwillingness of managers of large firms that report losses to make the situation worse, and/or incurring reputation loss in the market for corporate managers. Future study should address this issue that involves conflicting motives between acknowledging difficulty or manipulation, and the settlement cost of the managers.

[22] This statistic is calculated as follows: $W=n[b^1/6+(b^2-3)^2/24]$, where b^1 is skewness, b^2 is kurtosis and n is the number of observations. W is asymptotically distributed as chi-squares with two degrees of freedom (Jarque and Bera, 1987).

[23] Van der Waerden's approach of normal transformation can be achieved by dividing the rank of actual observations (r) into the number of observations (n), plus one region [r/(n+1)]. Advantages of this procedure include meaningful F and t-statistics as well as coefficients being produced, and therefore significance level can then be determined (Cooke, 1998)

Table 6
Regression results of discretionary accruals of debt renegotiating and control firms

Independent	*Predicted sign*	*Model 1*	*Model 2*	*Model 3*	*Model 4*
Constant	?	–0.591** *(–5.169)*[a]	–0.606** *(–5.200)*	–0.332** *(–4.911)*	–0.358** *(–4.990)*
AuditQ[b]	(–)	–0.103** *(–2.591)*	–0.108** *(–2.661)*	–0.060* *(–2.571)*	–0.067** *(–2.699)*
ChgMgt[b]	(–)	0.023 *(0.749)*	0.031 *(1.020)*	0.006 *(0.311)*	0.009 *(0.483)*
Nego[b]	(–)	–0.069** *(–2.518)*	–0.078** *(–2.788)*	–0.046** *(–2.824)*	–0.052** *(–3.048)*
Perform[b]	(+)	–0.017 *(–0.775)*	–0.010 *(–0.455)*	–0.005 *(–0.413)*	–0.001 *(–0.293)*
Lev[b]	(–)	–0.020** *(–3.798)*	–0.019** *(–3.655)*	–0.011** *(–3.751)*	–0.012** *(–3.712)*
Size[b]	(–)	0.080** *(3.767)*	0.080** *(3.701)*	0.046** *(3.641)*	0.046** *(3.441)*
Big-5[b]	(+)	0.057* *(1.971)*	0.066* *(2.243)*	0.039* *(2.309)*	0.043* *(2.382)*
CR	(+/–)	0.007 *(0.351)*	0.007 *(0.960)*	0.006 *(1.272)*	0.006 *(1.255)*
N		210	210	210	210
F-Stat		8.614	9.124	9.400	10.065
(p-value)		*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
Adj. R^2		22.7%	23.9%	24.5%	25.9%

[a] Figures in the parentheses are t-statistics.

[b] *AuditQ* is a dummy variable that takes the value of 1 if the firm receives an audit qualification during the year, otherwise 0; *ChgMgt* is a dummy variable that takes the value of 1 if a new executive or managing director is appointed in the negotiation year, otherwise 0; *Nego* is a dummy variable that takes the value of 1 in the first year of debt renegotiation; *Perform* is measured as prior period's return-on-assets ratio; *Lev* is total debt-to-total assets ratio; *Size* is measured as the natural log of total assets; *Big-5* is a dummy variable that takes the value of 1 if the firm is audited by a Big-5 audit firm, otherwise 0; and *CR* is the ratio of current assets of current liabilities at the end of the year.

Model 1 is total accrual cross-sectional Jones model with total accruals measured using the cash flows approach (Operating Cash Flows – Profit before tax and extraordinary items), Model 2 is total accrual cross-sectional modified Jones model, Model 3 is working capital accrual model (working capital is changes in working capital accounts found in the operating section of the statement of cash flows) when it is assumed that all revenues are not managed, and Model 4 is a working capital accrual model when it is assumed that only cash revenues are not managed.

*,**, significant at the 5% and 1% respectively (one-tailed for directional variable).

mained mostly similar. Our interacting term *Nego***Lev* is also significantly negative ($p<0.05$) across the four models. To investigate whether the results are stable after controlling for heteroscedasticity, all multivariate regressions are repeated to adjust the t-statistics based on White's heteroscedasticity-consistent standard errors and covariance. The results show that after the t-statistic correction, Nego is still significant at the conventional 5% level in all models.

The above results might be affected due to the sample being drawn from different industries. As there are five industries, we include a dummy variable for each industry in the model. The results (not presented) indicate that *Nego* is significantly negative ($p<0.01$) in all models and the models are significant ($p<0.01$) with an adjusted R^2 ranging from the lowest of 26.9% (model 2) to the highest of 31.9% (model 4). It is also noted that no particular industry has driven the significant results. We also re-estimate models 1–4 without the dummy *Nego*, since *CR* is found to be significantly lower

Table 7
Regression results of discretionary accruals (normal score) of debt renegotiating and control firms

Independent	*Predicted sign*	*Model 1*	*Model 2*	*Model 3*	*Model 4*
Constant	?	–1.753**	–1.809**	–1.770**	–1.655**
		(–3.202)[a]	*(–3.350)*	*(–3.265)*	*(–3.364)*
AuditQ[b]	(–)	–0.449**	–0.472**	–0.446*	–0.457*
		(–2.236)	*(–2.515)*	*(–2.371)*	*(–2.443)*
ChgMgt[b]	(–)	0.123	0.139	0.017	0.031
		(0.854)	*(0.976)*	*(0.122)*	*(0.221)*
Nego[b]	(–)	–0.244*	–0.274*	–0.311**	–0.337**
		(–1.856)	*(–2.146)*	*(–2.386)*	*(–2.604)*
Perform[b]	(+)	–0.039	–0.046	–0.031	–0.033
		(–0.369)	*(–0.433)*	*(–0.292)*	*(–0.317)*
Lev[b]	(–)	–0.076**	–0.080**	–0.073**	–0.073**
		(–3.091)	*(–3.272)*	*(–2.975)*	*(–2.999)*
Size[b]	(–)	0.319**	0.329**	0.321**	0.332**
		(3.131)	*(3.280)*	*(3.185)*	*(3.314)*
Big-5[b]	(+)	0.313*	0.337**	0.368**	0.354**
		(2.259)	*(2.469)*	*(2.685)*	*(2.605)*
CR	(+/–)	0.037	0.036	0.047	0.048
		(1.057)	*(1.025)*	*(1.342)*	*(1.390)*
N		210	210	210	210
F-Stat		6.676	7.567	7.596	7.994
		(0.000)	*(0.000)*	*(0.000)*	*(0.000)*
Adj. R^2		18.0%	20.2%	20.3%	21.3%

[a] Figures in the parentheses are t-statistics.

[b] *AuditQ* is a dummy variable that takes the value of 1 if the firm receives an audit qualification during the year, otherwise 0; *ChgMgt* is a dummy variable that takes the value of 1 if a new executive or managing director is appointed in the negotiation year, otherwise 0; Nego is a dummy variable that takes the value of 1 in the first year of debt renegotiation; *Perform* is measured as prior period's return-on-assets ratio; *Lev* is total debt-to-total assets ratio; *Size* is measured as the natural log of total assets; *Big-5* is a dummy variable that takes the value of 1 if the firm is audited by a Big-5 audit firm, otherwise 0; and *CR* is the ratio of current assets to current liabilities at the end of the year.

Model 1 is total accrual cross-sectional Jones model with total accruals measured using the cash flows approach (Operating Cash Flows – Profit before tax and extraordinary items), Model 2 is total accrual cross-sectional modified Jones model, Model 3 is working capital accrual model (working capital is changes in working capital accounts found in the operating section of the statement of cash flows) when it is assumed that all revenues are not managed, and Model 4 is a working capital accrual model when it is assumed that only cash revenues are not managed.

*,**, significant at the 5% and 1% respectively (one-tailed for directional variable).

in the test sample compared with the control sample. We find that *CR* is not significant in any model, which further supports our results in that this variable has not driven the *Nego* to be significant.

Since our regression results are based on two negotiation years (1998 and 1999), we estimate the regression coefficients on all explanatory variables for each year. The year-wise regression models do not indicate any material changes to the results reported in Tables 6 and 7. *Nego* is significantly negative (between 1% and 5%) in all models in 199 and 1999, and the adjusted R^2 varies between 16% and 26%.

We also test the effect of CDRC assistance o accounting choices of distressed firms. Becaus firms under CDRC assistance report lower *RO* (Table 2), we suspect that firms receiving government assistance may have incentives to repor lower *DAC* than firms who have renegotiated thei debts independently. Untabulated results revea that the difference in *DAC* between these two sub-samples is not significant, with the t-statistics varying between 0.432 and 0.929.

7. Summary and conclusions

This paper provides evidence of earnings management by distressed firms in Malaysia during the Asian financial crisis. Unlike prior studies that defined distressed firms based on dividend cut, negative earnings and close to debt covenant violation, our sample is selected based on firms that have actually defaulted on debt repayment and have undergone debt renegotiation with lenders during the period of 1998–1999 when Malaysia experienced severe financial crisis.

Our sample consists of 153 firms listed on the KLSE, of which 36 firms renegotiated debts with government support (CDRC), 58 firms renegotiated without government support and 59 poorly performing firms which have maintained debt repayment.

We estimate discretionary accruals using four well-established models, such as the Jones (1991), the modified Jones (1995), and the working capital version of the models. We find that firms have significantly negative accruals during the negotiation periods. This result is consistent with the explanations in DeAngelo et al. (1994), Bergman and Callen (1991), and Jaggi and Lee (2002).

To control for a performance related omitted variable, we compared discretionary accruals with other poorly performing firms which have not undertaken debt renegotiation with their lenders and find that firms which have undertaken debt restructuring have significantly more negative discretionary accruals than their other poorly performing counterparts. This result holds after controlling for variables such as audit qualifications, changes in top management, audit firm size, and traditional measures such as size, performance, leverage and liquidity, in a multivariate setting. The results are robust to using normalised rank scores without winsorising discretionary accruals.

Since our debt renegotiating firms comprised of CDRC (government assistance) and non-CDRC firms (without government assistance), we suspect that CDRC firms would employ more negative discretionary accruals in order to extract more government support. However, we do not find any statistical support for this conjecture.

The conclusions drawn from our study are constrained by several limitations. First, we note that sample firms exhibit large negative discretionary accruals during their financial difficulties. This high level of negative discretionary accruals may be due to sample selection bias associated with our definition of distressed firms since such firms are expected to experience unusually low accrual realisations during economic recession in Malaysia. Further, several firms may have adopted accounting policies that are not necessarily discretionary in nature, but the established models used in this study consider them as being discretionary.[24] Consequently, the *DAC* reported in our study might have been inflated due to the use of the standard abnormal estimation model.

Second, as stated earlier, it is possible that the magnitude of negative discretionary accruals has increased due to the reversal of some past income increasing discretionary accruals in the two and three years prior to debt defaults. Third, according to Young (1998), established models for estimating discretionary accruals contain significant measurement error due to misspecification of the accounting proxies, despite controlling for known potential sources of such error such as operating cash flows. To the extent that this measurement error is correlated with Nego and other control variables, the probability of committing a type I error is increased. Fourth, there are questions whether the evidence of decreasing discretionary accruals reported in this study is due to acknowledging problems (signalling), or efficiency on the part of the firm, real economic decision, opportunistic activity, or a combination of these motives. We are unable to delineate the effect of each of these motives. Future research should examine these issues, i.e., whether earning management is opportunistic or efficient by studying the market reaction to the existence of significant negative discretionary accruals.

Finally, despite incorporating several control variables in the regression model, there are omitted variables problem as is evident from a low adjusted R^2 across the four models. For example, we could not incorporate corporate governance variables including managerial ownership that usually affect accounting based accruals and performance (Bowen et al., 2002).

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[24] For example, loss or gain on non-discretionary sale of assets and forced adjustments affecting total accruals.

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The portfolio of knowledge required by industry specialist auditors

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Abstract—While a number of studies have shown the superior performance of industry specialist auditors, prior research has not examined the underlying knowledge categories reflective of a specialist. This study aims to identify the range of knowledge required to be a successful industry specialist auditor, and the ways in which this knowledge is and might best be acquired. A multi-method approach was employed, including the use of a free-list task to identify important categories of knowledge, and a structured questionnaire. The questionnaire examined several issues including current knowledge of specific items, extent to which specialist knowledge is reflected in the firm's support systems, and methods by which this knowledge was, and could be, acquired. Participants, designated insurance industry specialists from a Big 4 firm, identified a large range of knowledge items, and there was a large degree of consensus between the results arising from the two knowledge identification research methods utilised. The results also revealed a number of perceived deficiencies in the level of current knowledge and the extent to which specialised knowledge is reflected in support systems. Few differences were found in the knowledge requirements of the two industry sub-specialisations, life insurance, and property and casualty insurance. Except for industry and economic factors, on-the-job experience was found to be the most prevalent method of gaining industry specialist knowledge. However, there was support for greater formal training and improved firm support systems for several specific knowledge items.

1. Introduction

There has been a trend over the past two decades towards increased industry specialisation in public accounting. Several reasons have been offered for this development, including the ability of firms to differentiate their product, and to enhance audit efficiency and/or effectiveness as a result of specialist knowledge required to address the unique nature of the industry environment (Solomon et al., 1999; Wright and Wright, 1997; Emerson, 1993). Research demonstrates that such knowledge is related to higher quality decision-making (Abbott et al., 2000; Dunn, Mayhew and Morsefield, 2000; Solomon et al., 1999; Wright and Wright, 1997; Bonner and Lewis, 1990).[1]

However, little is known about the portfolio of knowledge items that are considered important for an industry specialist auditor that lead to higher quality decision-making. Studies to date tend to examine only one or two knowledge items. For example, Solomon et al. 1999 investigate knowledge of error frequency and plausible hypothesis generation as outcomes resulting from a better-developed knowledge of business operations. Further, studies to date have yet to determine the ways in which this knowledge is acquired (e.g.,' on-the-job' experience, formal training). An aim of this study is to address this gap in the literature by examining the breadth of knowledge categories encompassing industry specialisation. Additionally, within an industry specialisation, as will be discussed further, there are often recognised sub-specialisations. The study also examines areas of sub-specialisation and the extent to which knowledge requirements differ within sub-specialisations.

A final aim of the study is to identify auditors' perceived current level of knowledge and the extent to which specialist knowledge is reflected in the firm's decision support systems. Decision aids, including the more recent use of knowledge management systems, are widely employed in auditing practice (Cohendet et al., 1999). By comparing the knowledge levels or extent to which that knowledge is contained in the support systems with the level required for an industry specialist auditor, perceived deficiencies in knowledge requirements or support systems may be identified. The study, thus, provides empirical evidence that has implications regarding the nature of industry expertise and how it is (can be) developed.

The study was undertaken within two offices of the same Big 4 accounting firm. The industry set-

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[1] See Gramling and Stone (2001) for a thorough review of the literature on industry specialisation in auditing.

ting examined was insurance which has a unique set of business and accounting issues and one that is a recognised area of specialisation. Using a multi-method approach, entailing both a free list task and a structured questionnaire, 29 designated experienced industry specialists (partners/principals or managers) participated in the study.

The findings indicated that participants considered a large range of knowledge items to be important for an insurance industry specialist. A number of perceived deficiencies were noted in the level of current knowledge and the extent to which specialised knowledge is reflected in support systems. The most prevalent method of gaining industry specialist knowledge was through on-the-job experience. However, it was found that there was a perceived need for more formal training and improved firm support systems for a number of specific knowledge items.

It was also found that there are two sub-specialisations within the industry specialisation: life insurance and property and casualty insurance. Both of the sub-specialisations have about the same number of staff working for them in each of the offices. About 20% of the auditors work across both specialisations, although most of these tend to spend more time working in one specialisation. With a few exceptions the importance of knowledge categories was similar across the two sub-specialisations.

The remaining sections of the paper are structured as follows: the next section provides a review of the background literature. This section is followed by the research questions, research methods, data analyses and results. The final section discusses the findings and explores their implications for practice and future research.

2. Literature review and development of research questions

The concept of industry specialisation by auditors is not new. Eichenseher and Danos (1981) argued that industry specialists may achieve economies of scale by having a greater understanding of clients' environmental influences and provided evidence that industry specialisations exist in public accounting. There are two distinct streams of auditing literature that have examined the issue of industry specialisation, the economics of auditing literature which has examined industry specialisation at the office or firm level, (for example, DeFond, 1992; Williams, 1988; Craswell et al., 1995; Johnson and Lys, 1990; DeFond et al., 2000; Ferguson and Stokes, 2002) and the behavioural auditing literature which has sought to identify and examine specific aspects of knowledge that are, or could be inferred to be, important for individual industry specialist auditors.

This study contributes to the behavioural auditing literature by attempting to identify the range of knowledge items important for industry specialists, and how this knowledge is, and can best be, acquired. In one of the earlier studies, Bonner and Lewis (1990) explored a view of expertise in which specific experiences and training created knowledge, which in turn was combined with innate ability to improve performance on specific audit tasks. Three types of knowledge were highlighted: general domain knowledge (general knowledge of accounting and auditing); task-specific knowledge (enhanced knowledge acquired in a particular auditing task); and domain-specific knowledge (specialised knowledge acquired through familiarity with a particular area of accounting or auditing, for example, accounts or industries). Thus, industry specialisation is considered a form of domain-specific knowledge.[2]

A number of studies have investigated the effects of domain-specific knowledge on auditor judgements. For example, Bedard and Biggs (1991) found that auditors with greater experience in manufacturing (the context of the experimental case) were more likely to identify errors present in a complex analytical procedures task. Similarly, Taylor (2000) examined auditor inherent risk judgements of banking and non-banking specialists. His results indicated an increased conservatism for auditors lacking industry experience and provided limited support that industry specialisation enhances auditor sensitivity to risk variations. Wright and Wright (1997) investigated the effect of industry experience on hypothesis generation and risk assessment in a retailing case where material errors were present. Their results indicated that auditors with industry specialist audit experience have both superior hypothesis generation skills and an enhanced ability to identify industry unique areas of audit risk over non-specialists.

Solomon et al. (1999) examined whether knowledge of business operations is a key component of audit industry specialists' knowledge and a factor in distinguishing levels of audit task performance. Industry specialists were found to have both a greater quantity of knowledge as well as more specific business operations knowledge stored in and retrievable from memory, for their industry of specialisation relative to another industry. That is, industry experience was found to enhance auditors' error frequency knowledge and ability to generate plausible hypotheses for a client in their area of specialisation, but not necessarily so for other industry settings. Taken together, these studies suggest that industry specialists develop unique knowledge compared to non-industry specialists. Thus, it appears that industry experience is a separately identifiable dimension of domain-specific experience and raises issues about what types of knowledge specialists possess that provides them with a competitive advantage over non-specialists and how this knowledge can most effectively be developed.

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[2] The types of domain-specific knowledge, however, may overlap. For instance, it is likely that there are unique types of errors and risks for a particular industry relating to specific accounts, and, thus, an industry specialist will likely be more aware of these issues at the account level than a non-specialist. For instance, risks related to the inventory account vary across industries, e.g., obsolescence for high technology products.

Prior behavioural studies of industry specialists have focussed on a limited set of specialist knowledge items, for example, error frequency knowledge and knowledge of business operations. There has been little research that has attempted to identify the range of knowledge items important for audit industry specialists, or how this knowledge is, or can best be, developed. Some of the protocol research (for example Mock and Turner 1981; Biggs et al. 1989) has attempted to identify the decision processes of experienced auditors. Evidence on these issues is important for practice in terms of staff development and decision support as well as for research in examining factors contributing to superior performance. Evidence as to the breadth in the portfolio of knowledge, and whether this portfolio differs between different industry sub-specialisations may also contribute to knowledge of the costs of mandatory auditor rotation policy. For instance, rotation to a non-specialist firm may result in impairing audit effectiveness and the reliability of the underlying financial statements on which users rely. Alternatively, the costs for the non-specialist firm to develop the expertise necessary to obtain the required knowledge may be prohibitive.

Auditing standards identify several types of specific knowledge items that are considered to be important for auditors. For example, International Auditing Standards ISA 310 'Knowledge of the Business' and ISA 500 'Audit Evidence' state that knowledge is required in the following broad categories: general economic factors; important conditions affecting the industry and entity; managerial and ownership considerations; and an entity's business, financial performance and reporting environment. These sources suggest there is a diversity of types of knowledge that an industry specialist requires, leading to the first research question:

RQ1: What is the portfolio of knowledge that is beneficial for an industry specialist auditor?

Of interest is the degree to which the firm's support systems provide information on various important industry knowledge items. While the professional accounting firms are generally acknowledged as having some superior knowledge of management systems (e.g., Cohendet et al., 1999), very little is known of the extent to which they support the knowledge required of industry specialists. This issue is addressed by the following research question:

RQ2: To what extent do current decision support systems provide the knowledge considered important for industry specialist auditors?

Research question three identifies the knowledge items for which specialists perceive they have a need for greater knowledge. Auditing firms may then examine whether these are areas where additional focus is required through, for instance, training or the development of further decision support. We therefore examine the following research question:

RQ3: Are there perceived deficiencies in current knowledge levels for knowledge categories considered important for industry specialist auditors?

This study also contains a comparison of the importance of various types of knowledge for industry specialists working in two identified industry sub-specialisations within the insurance industry: life insurance and property and casualty insurance. This is the first study that has examined industry sub-specialisations. In particular, the research focuses on the extent to which there are common knowledge requirements between different sub-specialisations. There may be unique regulatory or accounting standards requirements for each sub-specialisation, or a differing impact of other considerations such as environmental concerns.[3] To explore the nature of differences between the knowledge considered important between insurance auditing specialists in the different industry sub-specialisations the following research question is examined:

RQ4: Will the perceived relative importance of various industry specialist knowledge items vary for industry specialists in different industry sub-specialisations?

Also of interest is the manner in which various types of knowledge are acquired, through on-the-job experience, formal training, or other mechanisms such as private reading, research, and consulting with other practitioners. There is a large body of research in psychology on knowledge acquisition (e.g., Anderson, 1995; Gagne, 1968, 1984; Gagne and Medsker, 1996; Schunk, 1996). However, there has been little work in this area of accounting (Bonner and Walker, 1994; Bonner and Pennington, 1991), and on the issues of how industry specialists obtain their knowledge, and how further knowledge could be optimally acquired if needed. Thus, the final research question explores this issue:

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[3] For instance, environmental liabilities for companies to clean up polluted sites may be covered by insurance policies in the property and casualty area but would not be of concern for insurers of life insurance.

RQ5: What are the predominant mechanisms for obtaining the various types of specialist knowledge and how can further knowledge be effectively acquired?

3. Research method

3.1. Subjects and administration

Experienced specialist auditors were sought in a recognised industry that requires specialist knowledge and where there were sufficient numbers of specialists for statistical analyses to participate in the research study. A review of knowledge requirements and discussions with partners at two offices (Boston and Sydney) of a participating Big 4 firm indicated that the insurance industry would meet these considerations. Using a single firm that utilizes a worldwide audit approach allowed us to avoid potential confounding differences in auditor responses between the two offices due to firm-specific practices. However, it is recognised that this approach does limit our ability to generalise our results due to a potential firm effect.

The insurance industries in the US and Australia have followed similar paths of demutualisation over the last two decades. In choosing both Australia and the US we are examining two environments where prior research has shown that similar market conditions and cultures exist. Therefore, we expect similarities in knowledge items considered important. The one major difference is that the Australian insurance industry is regulated primarily at the federal level while in the US the industry is regulated at the state level.[4]

As will be discussed later, additional analyses revealed only a small number of significant differences in participant assessments of the importance of various knowledge items, relating primarily, as expected, to the category of regulatory and legal. As a result, the participant findings are combined in reporting the primary results.

The firm is one of the leading assurance providers in the insurance industry, with over 100 staff at each of the participating offices working within this specialisation. Specialist auditors were identified, and participated on an availability and voluntary basis.

To identify important types of specialist knowledge we sought experienced individuals who were classified by the firm as leading industry specialists, and were at the supervisor or higher levels. The total number of designated specialists at or above these levels at the two offices was 38. Nine potential subjects were unavailable at the times the study was conducted. In all, 29 designated specialists participated, sixteen specialists from the US office and 13 specialists from the Australian office. Thirteen of the specialists worked in the life insurance sub-specialisation (nine from the US) and 16 worked in the property and casualty sub-specialisation (seven from the US).[5] Thus, 76% of the firm's designated specialists for these two offices participated. An hour was allotted to each specialist in order to complete a number of tasks including the free list, questionnaire and debriefing tasks (however, this time was exceeded in a number of instances). Thus the data was collected under controlled conditions on an individual basis, with at least one of the researchers present for every interview. The researchers provided clarification where questions from participants arose and sought additional information for incomplete or unclear responses. Other than this minimal intervention, participants completed the structured research tasks. Ten of the subjects (34.5%) were audit partners/principals and 19 (68.5%) were managers/supervisors. Importantly, participants had extensive industry experience (average of 9.6 years of insurance experience) and time working with the firm (average of 11.4 years).

3.2. Identification of industry specialist knowledge

As noted, to address the research questions, two main research methods were employed: a free list task and a questionnaire. The free list task was undertaken before the questionnaire to ensure that the participants' views were not influenced by the knowledge items contained in the questionnaire. The instructions on the free list task asked the participant to identify 'the knowledge items that you bring to an audit in your industry specialisation which allow you to perform the audit more effectively or efficiently than an auditor with equivalent experience but who hasn't audited in your (the insurance) industry'. Subjects were asked to be as specific as possible, and after completing the list, they were asked to indicate the importance of each item by circling a number between 1 and 7, where 1 was of minimal importance and 7 was of extreme importance. The main advantage of the free list is that subjects are not constrained in their thinking, resulting in an unobtrusive trace of items from long-term memory (Weber, 1980). The disadvantage of this approach is that research has shown individuals often have limited self-insight as to cues and knowledge utilized (Ashton 1982). This disadvantage was mitigated by the second data collection method, a structured questionnaire, as outlined below. The use of a multi-method approach in this study attempted to capture the advantages and mitigate the disadvantages of one method over another.

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[4] In Australia there is supervision at the federal level, predominantly undertaken by the Australian Prudential and Regulatory Authority who introduced six standards in 2002. In addition the industry provides self regulation through a General Insurance Code of Practice and General Insurance Enquiries and Complaints Scheme. In contrast the US is primarily regulated on a state-by-state basis. The various state Insurance Commissioners monitor financial conditions and ensure the availability of essential insurance coverage for all consumers and provides consumer protection. The Commissioners actions are subsequently coordinated at a federal level under the National Association of Insurance Commissioners.

As expected, the size of the US insurance industry vastly surpasses that of Australia. As at December 2001, the US life insurance industry comprised of $US 3.26 trillion in assets. This is highly concentrated, with the 10 largest life insurers comprising 45% of the assets. Comparably, the entire Australian insurance industry stood at $A 265 bn in assets.

[5] Five specialists worked in both sub-specialisations. They were allocated to the sub-specialisation to which they indicated that they spent more of their time. Sensitivity analysis showed that dropping these specialists did not change the significant results.

In developing the questionnaire, the first requirement was to identify the potential range of specialist industry knowledge that may be of benefit to the auditor. Thus, the instrument included areas that have been noted in the literature, professional standards or prior research as being potentially important knowledge for industry specialist auditors. To ensure other important knowledge items that were not listed in the questionnaire would nonetheless be identified, participants were provided with an opportunity to add additional knowledge items to the end of each knowledge category.[6] Based on the literature review and categorisations used in the standards, six broad knowledge categories, capturing 29 knowledge items, were constructed. First, various **regulatory and legal** requirements relating to a specific industry can be critical when assessing factors such as audit risk and the existence of contingent liabilities. Second, many industries have a unique business and economic environment (**industry and economic**), and this form of knowledge has become more important under the new business risk audit approaches (Lemon et al., 2002; Winograd et al., 2000; Bell et al., 1997), as utilised by the public accounting firm in this study. Third, for many industries, there are unique **accounting** standards, issues and practices, which must be understood in order to audit effectively. Fourth, knowledge that is **entity-specific** such as organisational structure and customer and supplier profile may be needed to analyse the client in its industry context. Fifth, knowledge of **auditing** standards and techniques appears to be important in effectively auditing a client within an industry. Finally, there appear to be **other knowledge and skill** requirements that are required by a specialist, such as knowing with whom to consult when specific problems are identified. These broad knowledge categories, each containing a number of specific knowledge items, were used in the questionnaire to collect information as to the relative importance of each item from the specialist industry auditors.

The free list task and the questionnaire were pilot tested with six industry specialists, from the same firm but from a different office than those participating in the study. The questionnaire was also reviewed by a number of academics. As a result of this process, a number of revisions were made to the wording of questions contained in the final questionnaire. These revisions primarily increased the exposure to knowledge related to the newer business risk auditing approaches and resulted in additional questions to capture the extent to which knowledge required to be a successful industry specialist is reflected in the firm's decision support systems. The final version of the questionnaire captured data for 29 specific knowledge items contained in the six broad knowledge categories outlined earlier, as shown in the first two columns of Table 1.

For each of these 29 knowledge items, the questionnaire captured the assessments of industry specialists regarding the following areas of interest:

(1) the importance of a knowledge item for an industry specialist, i.e., auditors were asked to identify what they considered to be an adequate level of knowledge for a particular knowledge item in order to be a successful specialist, and rank their response on a 7-point Likert scale (1 = a low level of knowledge and 7 = a high level of knowledge). In conjunction with the free list task, this helped inform Research Question 1;

(2) the extent to which knowledge to be a successful specialist is reflected in the firm's decision support system, i.e., responses were indicated on a 7-point Likert scale with the same anchors. This helped inform Research Question 2;

(3) the current levels of knowledge for that particular knowledge item, i.e., once again, responses were indicated on a 7-point Likert scale

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[6] There were few instances of use of this 'Other' category. Seventeen (58.6%) specialists did not list any additional knowledge items. Of the remaining 12 specialists that did provide additional items, six specialists listed one, three listed two, one listed three, one listed four and the final one listed six additional items. The major items listed were distribution method (five times) and knowledge of international accounting standards and practices (three times). The issue of knowledge of the distribution network for policies (e.g., insurance agents, etc.) was identified during the free list task and those who identified it were asked to add it to their questionnaire. These findings provide support for the claim that all major specific knowledge items had been identified and included in the questionnaire.

Table 1
Number of auditors free listing specific knowledge items

Knowledge category	*Specific knowledge items*	*Total (N=29)*	
		No.	*%*
Regulatory & Legal	R1 - Federal Regulations (RF)	8	27.59
	R2 - State and Local Regulations (RS)	10	34.48
	R3 - Environmental Considerations (RE)	2	6.90
	R4 - Other Regulatory & Legal Factors	9	31.03
Industry & Economic	I1 - Levels of General Economic Activity (IE)	6	20.69
	I2 - Level of Industry Activity (II)	16	55.17
	I3 - Industry Structure (Concentration) (IS)	9	31.03
	I4 - Competitor Analysis (IC)	8	27.59
	I5 - Industry Technology (IT)	6	20.69
	I6 - Other Industry & Economic Factors	11	37.93
Accounting	A1 - Accounting Practices / Disclosures in Industry (ACP)	10	34.48
	A2 - Accounting Standards (General) (ACG)	4	13.79
	A3 - Accounting Standards (Industry Specific) (ACS)	12	41.38
	A4 - Current Accounting Issues (ACI)	2	6.90
	A5 - Other Accounting Factors	2	6.90
Entity-specific Factors	E1 - Organisational Structure (EO)	2	6.90
	E2 - Management Objectives, Philosophies and Strategic Plans (EP)	4	13.79
	E3 - Management Strategic Analysis (EA)	5	17.24
	E4 - Customer Analysis (EC)	1	3.45
	E5 - Supplier Analysis (ES)	0	0.00
	E6 - Products/Business Processes (EB)	25	86.21
	E7 - Other Entity-specific Factors	8	27.59
Auditing	AU1. Inherent Risks for Industry (AUI)	4	13.79
	AU2 - Knowledge of Control Risks and Systems (AUC)	2	6.90
	AU3 - Auditing Standards (General) (AUG)	0	0.00
	AU4 - Auditing Standards (Industry Specific) (AUS)	0	0.00
	AU5 - Auditing Techniques (AUA)	3	10.34
	AU6 - Knowledge of Where Errors Frequently Occur (AUE)	0	0.00
	AU7 - Analytical Procedures (AUR)	4	13.79
	AU8 - Knowledge of Expected R/ships Btn Account Balances (AUB)	1	3.45
	AU9 - Other Auditing Factors	3	10.34
Other Knowledge & Skills	O1 - With Whom to Consult for Identified Problems (OW)	3	10.34
	O2 - Knowledge to Use Specialised Industry Database Available in Firm (OD)	1	3.45
	O3 - Client Service Needs (ON)	0	0.00
	O4 - Other Knowledge & Skills Factors	7	24.14

with the same anchors. A significant difference between the response to this question and the importance of a knowledge item would identify perceived deficiencies in current knowledge levels (Research Question 3);

(4) the methods used to acquire this knowledge, i.e., responses were apportioned in percentages totalling 100% across three different methods, being formal training, on-the-job training, and other methods (informing the first part of Research Question 5); and

(5) an assessment of how further knowledge could best be acquired (informing the second part of Research Question 5). Responses were indicated on a 7-point Likert scale (1 = too little emphasis; 4 = appropriate emphasis; and 7 = excessive emphasis on the method), across the same three methods of knowledge acquisition outlined in (4) above.

For the first and second assessments outlined above, subjects were asked to evaluate the level needed for each knowledge item to be a 'successful' specialist, an expression that was deliberately not defined by the researchers. Rather, at the start of each session we asked the participant to identify and define what they saw as a successful specialist.[7] This approach was undertaken because, rather than defining what 'success' embodies, we wanted each participant to work with their own definition of a successful specialist in identifying their perspective of the relative importance of each type of knowledge to superior performance.

3.3. Coding of the free list task

The responses to the free list task were separately coded by each of the researchers. The responses of three participants were initially examined in order to develop a coding scheme. It was found that the free list responses could be classified into the 29 knowledge items that were identified earlier and used in the development of the questionnaire. When this finding was combined with the result that there was no general consensus on additions to the 29 knowledge items identified, it was decided to code the free list task in accordance with this coding scheme. One major advantage of this approach was ease of comparison over the two stages of knowledge identification. To deal with situations where some of the items that were free listed were not easily coded into the 29 knowledge items, an 'other' classification was created for each of the six broad knowledge categories outlined earlier. This meant that both of the researchers were required to code the responses of the free list task into 35 knowledge items. The level of inter-coder agreement at the first parse was over 80% ($p<.01$) and all differences were resolved by mutual agreement. The tables reported in the paper represent the agreed-upon coding.

4. Results

Findings for the research questions

RQ 1 examines the types of knowledge that are important for an industry specialist auditor. This was identified by the free list task and the questionnaire. The results of the free list task are shown in Table 1.

The items listed most frequently and their relative importance (on a 1–7 point Likert scale where 1 = Minimal Importance and 7 = Extreme Importance) were:

- knowledge about products and business processes (listed by 25 specialists; average importance rating 6.32);
- level of industry activity (16 specialists; average importance rating 5.60);
- accounting standards (industry specific) (12 specialists; average importance rating 6.02);
- other industry and economic factors (11 specialists; average importance rating 5.60);
- accounting practices, disclosures in the industry (10 specialists; average importance rating of 6.30); and
- state and local regulations (10 specialists;[8] average importance rating 5.70).

The one item that was referred to a number of times that was not contained in the questionnaire was the client's distribution system, i.e., the mechanisms by which insurance policies are sold. The participants who included this item all suggested that the style of distribution system was unique to the insurance industry. The broad category of knowledge items that had the least items free-listed was the auditing category. This finding indicates that specialists did not see auditing knowledge as a major differentiating dimension of their performance, suggesting that broad auditing skills and techniques are perceived as relevant and generalised across industries and are not unique to insurance clients. The second approach used to address RQ 1 was the questionnaire. The findings regarding auditors' assessments of the importance of various knowledge categories are shown in Table 2 under the column heading 'level of knowledge required to be a successful specialist'. This approach had the advantage of each of the information items being considered and ranked by all participants.

The knowledge items identified as most important (on a 7-point Likert scale) were:

- industry specific accounting standards (accounting): mean of 6.45*;
- products/business processes (entity-specific): 6.34*;
- accounting practices/disclosures in the industry (accounting): 6.34*;
- inherent risks for industry (auditing): 6.31;
- knowledge of expected relationships between account balances (auditing): 6.24;
- with whom to consult for identified problems (other): 6.10;
- client service needs (other): 6.10;
- level of industry activity (industry and economic): 6.00*.

It was found that there is a large overlap for the knowledge items identified as important by both the free recall and questionnaire procedures, with the four items that are followed by an asterisk (*) above also appearing on the free list task. The other items listed above that did not appear frequently on the free list task come from either the

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[7] By far the most common response was that a successful specialist was a person who had an ability to identify a client's needs and help them in achieving these needs. This response does raise questions as to whether the auditors believed the shareholders or the managers were their major clients. However, the data was collected pre-Enron and may not be reflective of current thinking.

[8] All 10 were US specialists.

Table 2
Results of t-test analysis for level of knowledge required to be a successful specialist, extent of specialist knowledge reflected in support systems and current level of knowledge

Knowledge category	*Specific knowledge items*	*Level of knowledge required to be a successful specialist*			*Extent of specialist knowledge reflected in support systems*			*Level of current knowledge*		
		Mean	*Median*	*Scheffe*	*Mean*	*Median*	*t value*	*Mean*	*Median*	*t value*[1]
Regulatory & Legal	1. Federal Regulations (RF)	5.00	5.00	abcd	4.79	5.00	0.76	4.10	4.00	4.11**
	2. State and Local Regulations (RS)	5.00	5.00	abcd	4.21	4.00	2.73	4.10	4.00	4.77**
	3. Environmental Considerations (RE)	2.90	3.00	a	2.90	3.00	0.00	2.41	3.00	2.32*
Industry & Economic	4. Levels of General Economic Activity (IE)	4.93	5.00	abcd	4.31	5.00	2.84**	4.45	4.00	3.14**
	5. Level of Industry Activity (II)	6.00	6.00	cd	5.41	6.00	3.10**	5.24	5.00	5.20**
	6. Industry Structure (Concentration) (IS)	5.38	6.00	bcd	4.93	5.00	1.79	4.83	5.00	3.02**
	7. Competitor Analysis (IC)	5.10	5.00	abcd	4.69	4.00	1.19	4.31	5.00	2.77*
	8. Industry Technology (IT)	4.14	4.00	abc	3.55	3.00	2.31*	3.41	3.00	3.4**
Accounting	9. Accounting Practices / Disclosures in Industry (ACP)	6.34	6.00	cd	6.14	6.00	1.44	5.55	6.00	4.08**
	10. Accounting Standards (General) (ACG)	5.55	6.00	cd	6.10	6.00	–3.59**	5.03	5.00	1.98
	11. Accounting Standards (Industry Specific) (ACS)	6.45	7.00	cd	6.17	6.00	2.29*	5.69	6.00	3.99**
	12. Current Accounting Issues (ACI)	5.86	6.00	cd	6.07	6.00	–1.44	5.24	5.00	3.00**
Entity-specific Factors	13. Organisational Structure (EO)	5.17	5.00	bcd	3.90	4.00	3.50**	5.07	5.00	0.57
	14. Management Objectives, Philosophies and Strategic Plans (EP)	5.55	6.00	cd	3.45	3.00	4.98**	4.72	5.00	4.45**
	15. Management Strategic Analysis (EA)	5.13	5.00	bcd	3.17	3.00	4.71**	4.14	4.00	5.59**
	16. Customer Analysis (EC)	4.24	5.00	abcd	3.03	3.00	3.40**	3.72	4.00	2.48
	17. Supplier Analysis (ES)	3.31	4.00	ab	2.24	2.00	3.18**	2.76	3.00	2.65*
	18. Products/Business Processes (EB)	6.34	7.00	cd	4.76	5.00	5.22**	5.29	5.00	7.91**
Auditing	19. Inherent Risks for Industry (AUI)	6.31	6.00	cd	5.52	5.00	3.17**	5.76	6.00	4.33**
	20. Knowledge of Control Risks and Systems (AUC)	5.83	6.00	cd	5.24	6.00	1.81	5.10	5.00	5.19**
	21. Auditing Standards (General) (AUG)	5.14	5.00	bcd	5.93	6.00	–3.31**	5.07	5.00	0.35
	22. Auditing Standards (Industry Specific) (AUS)	5.45	6.00	bcd	5.21	5.00	0.91	4.93	5.00	2.93**

Table 2

Results of t-test analysis for level of knowledge required to be a successful specialist, extent of specialist knowledge reflected in support systems and current level of knowledge (continued)

Knowledge category	*Specific knowledge items*	*Level of knowledge required to be a successful specialist*			*Extent of specialist knowledge reflected in support systems*			*Level of current knowledge*		
		Mean	*Median*	*Scheffe*	*Mean*	*Median*	*t value*	*Mean*	*Median*	*t value*[1]
Auditing (continued)	23. Auditing Techniques (AUA)	5.21	6.00	bcd	5.89	6.00	–2.77**	5.38	5.00	–0.82
	24. Knowledge of Where Errors Frequently Occur (AUE)	5.97	6.00	cd	4.79	5.00	3.31**	5.48	6.00	3.78**
	25. Analytical Procedures (AUR)	5.93	6.00	cd	4.96	5.00	2.24*	5.28	5.00	3.01**
	26. Knowledge of Expected Relationships Between Account Balances (AUB)	6.24	6.00	cd	4.76	5.00	3.94**	5.72	6.00	2.73*
Other Knowledge & Skills	27. With Whom to Consult for Identified Problems (OW)	6.10	6.00	cd	5.59	6.00	1.72	5.69	6.00	2.38*
	28. Knowledge to Use Specialised Industry Database Available in Firm (OD)	5.69	6.00	cd	5.79	6.00	–0.35	5.31	6.00	1.95
	29. Client Service Needs (ON)	6.10	6.00	cd	4.90	5.00	3.50**	5.21	5.00	3.82**

** – = significant at 0.01 level ; * = significant at 0.05 ; Response scale: 1 = Low level of knowledge; 7 = High level of knowledge.

a,b,c,d = entries in Levels of knowledge required column with difference descriptors are significantly different (p=.05) using Scheffe's test.

[1] Matched-pairs t-test with response to level of knowledge required to be a successful specialist.

'auditing' or 'other' categories. Thus it appears that auditors rank these items highly, although they did not think about them when they were asked to free-list the knowledge items that allowed them to perform the audit more effectively or efficiently. This demonstrates an advantage of the multi-method approach to collecting responses.

The items that received the lowest rating in terms of importance were environmental analysis, supplier analysis,[9] and industry technology.[10] Issues relating to the environment (e.g., pollution[11]) were not viewed as particularly relevant in the insurance industry (although there was a significant difference as to its relevance for each sub-specialisation, as discussed later), and information associated with customer and supplier analysis (emphasised under new audit methodologies) was replaced in many instances by an emphasis on the distribution system.[12] In all, the findings on RQ 1 indicate a wide breadth of important knowledge items. In addition, a series of One-way Anovas for each knowledge item examined potential differences as a result of the country of origin for each participant. The results revealed significant differences ($p \leq .05$) in the majority of knowledge items in only two of the six broad knowledge categories (regulatory and legal, and entity-specific factors) and for some specific knowledge items in the broad category of auditing. As expected, a greater importance of knowledge of federal regulations by Australian auditors and state regulations by US auditors reflect the fact that most of the regulation affecting insurance entities is through a federal system in Australia (federal regulations) compared to state and local systems in the United States (state and local regulations).

Higher levels of required knowledge were perceived in Australia for the entity-specific factors of management strategic analysis, supplier analysis, and customers/business processes. A higher level of required knowledge was also perceived in Australia for the auditing factors of inherent risks, knowledge of control risks and systems and knowledge of expected relationships between account balances,[13] while higher required knowledge of the auditing standards in general was perceived in the US. Interestingly, there were no significant differences perceived for any knowledge item requirements in the categories of industry and economic, accounting, or other. In all, as expected, there were few differences in the assessments of the importance of knowledge items between US and Australian auditors.

RQ 2 explored the extent to which the level of specialist knowledge required is provided in the firm's support systems, defined in the questionnaire to include audit manuals, decision support systems and other support technology. By comparing the responses to the questions concerning the level of knowledge required to be a successful specialist with the responses to the questions capturing the extent of knowledge reflected in support systems, we identified knowledge items where too little or too much direction is perceived to be supplied by firm decision aids. Matched pairs t-values of this comparison for the 29 knowledge items are contained in Table 2 under the column heading 'extent of specialist knowledge reflected in support system'.

The major finding here is that the respondents consider the support systems were deficient with regard to all the knowledge items contained in the knowledge category 'entity-specific factors'.[14] The support systems were also perceived to be deficient for some of the knowledge items in the 'industry and economic' knowledge category (general economic and industry activity) and information with regard to industry technology.

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[9] As identified in Footnote 6, there were five specialists who rated distribution method as an important separate component related, but additional to, supplier analysis. For these five people, supplier analysis had an average score of 6, significantly above the response of others for this knowledge item. Thus, caution must be taken in interpreting this result.

[10] Scheffe testing, outlined in Table 3, indicated that the responses for the first two of these items were significantly lower than the responses for the highly ranked knowledge items.

[11] During the sessions a number of subjects either asked or were asked how they interpreted environmental factors (this proved to be the most ambiguous knowledge item). The interpretation provided was that it related to the physical environment such as pollution, rather than the business environment, such as political and regulatory. This interpretation created the least overlap with other knowledge items.

[12] It needs to be remembered that if participants identified the distribution system in the free list stage, they were asked to include this as a separate category. These participants then had lower scores on average for customer and supplier analysis than other participants.

[13] These differences identified with the areas of entity-specific factors and auditing are consistent with greater attention being paid to areas of importance under the new business risk methodology. Although the firm had introduced their new audit business risk methodology at least 12 months prior in the two offices, the interviews were undertaken in Australia just over three months after the interviews were undertaken in the US. The identified differences in these categories are consistent with what you may expect to see be emphasized within the new business risk methodology, so we cannot discount different levels of familiarity with the new methodology (through such mechanisms as greater exposure over time or variation in training) potentially contributing or driving these results.

[14] This was despite the fact that the firm was able to show the researchers extensive confidential analysts reports produced for the firm on their main clients in the insurance industry. A review of a couple of these reports appeared to concentrate on identifying strategic business risks facing the client, and comparing the products, technology and strategic advantages of the client with those of their direct competitors. Some auditors commented that they found these reports useful. However, it appears that on the basis of some responses to this question, it may be beneficial to provide further guidance or clarification on how to use the information that was provided, or, alternatively, undertake a review to ensure that the information provided meets the needs of the auditor.

Respondents felt that adequate support systems were in place to provide the appropriate level of knowledge of industry structure and competitor analysis. For the knowledge category of 'auditing', it was perceived that the support systems could be improved with regard to inherent risk information and information related to error frequency and analytical procedures. This is consistent with the conclusions from Maletta and Wright (1996) and Bell and Knechel (1994) that errors differ between industries and auditors need to better understand the types and relative frequencies of errors in relation to the industry in which they are auditing. Appropriate information was generally perceived for all the knowledge items under the knowledge categories of 'regulatory and legal', 'accounting', and 'other'. The areas where too much support was perceived were general auditing and accounting standards and auditing techniques.

RQ 3 examines the extent to which there are perceived deficiencies in current knowledge levels for the knowledge items identified as being important for industry specialisation. To examine this question, the mean scores for 'level of current knowledge' and 'level of knowledge required to be a successful specialist' were compared for each knowledge item. Results of paired-sample t-tests are reported in Table 2 (column headed 't value' under 'level of current knowledge'). Taken together, the results in Table 2 suggest that many of the specialists had not achieved the level of knowledge they perceived was required to be a successful specialist. In fact, there were many perceived knowledge deficiencies. The major perceived knowledge gaps were for the two entity-specific factors of products/business processes and management strategic analysis. The major areas where knowledge deficiencies were not perceived to exist were the knowledge items of auditing techniques, general auditing standards and general accounting standards.[15]

RQ 4 examines knowledge differences in the two insurance sub-specialisations: life insurance and property and casualty (property and casualty insurance is called general insurance in Australia). To explore this matter, a series of One-way Anovas for each knowledge item was used to identify potential differences between specified major industry sub-specialisations. In general, few differences were identified. The four areas of significant difference regarding the response to 'level of knowledge required to be a successful specialist' were environmental considerations (higher for Property and Casualty), accounting standards –general (higher for Life), organisational structure (higher for Life), and client service needs (higher for Life). In all of the auditing knowledge items there was no difference in the level of knowledge required to be successful specialists. This provides evidence that while environmental, organisational and accounting standards issues may cause differences in knowledge requirements, overall the knowledge areas are largely equivalent for these two industry sub-specialisations.

RQ 5 explores the primary means of knowledge acquisition. Table 3 provides results on this issue. Regulatory and legal knowledge, entity-specific knowledge, and the items classified under 'other' were learned primarily through on-the-job training, while industry and economic knowledge was acquired primarily through reading and research. The knowledge requirements categorised under accounting and auditing were perceived as being learned through a combination of formal and on-the-job training. These findings suggest that a variety of mechanisms are used to provide industry-specific knowledge.

Respondents were also asked to assess how further knowledge could best be acquired, as presented in Table 3. The mid-point on the 7-point Likert scales represented a perception of correct emphasis, a score of one represented too low an emphasis and a score of seven represented too high an emphasis. Mean scores for the knowledge items (recorded in Table 3 under 'how further knowledge could best be acquired') were compared against the mid-point score of 4. An interesting finding was that it was felt that the specialists could benefit with more formal training on many of the knowledge items (24 of 29). The areas that were perceived to benefit most from formal training was knowledge of how to use the specialised industry databases available within the firm (mean of 3.03), followed in importance by a perceived need for further formal training in analytical procedures and industry technology (both means of 3.17). Debriefing responses suggested that in all these three areas there had been recent developments within the firm, with new relevant knowledge databases being developed, the business risk audit methodology emphasising a greater role for enhanced analytical procedures, and improvements in support system technology.

The general knowledge category where it was

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[15] A 2x2 ANOVA was also undertaken where the second dimension was to compare partners' responses with those of managers/supervisors. There was only one item where there was a significant difference perceived in the level of knowledge required to be a successful specialist. This was level of industry activity. Thus, perceptions of the level of knowledge required to be a successful specialist do not appear to differ between partners and managers/supervisors. There were, however, many differences perceived between partners' and managers/supervisors' level of current knowledge. Partners perceived they had a higher current level of knowledge compared with that perceived by managers/supervisors in a number of areas, including most auditing areas, with whom to consult for identified problems and client service needs. There were no differences as to perceived levels of regulatory and legal knowledge, nor accounting knowledge.

Table 3
Mean percentages of how current knowledge was acquired and mean ratings of how that knowledge can best be acquired (for entire sample)

Knowledge category	*Specific knowledge items*	*How current knowledge was acquired (mean %)*			*How further knowledge could best be acquired (mean rating)*		
		Formal Training	*On-the-Job Training*	*Other*	*Formal Training*	*On-the-Job Training*	*Other*
Regulatory & Legal	1.Federal Regulations	22.69	51.14	26.14	3.21**	3.97	4.14
	2. State and Local Regulations	17.07	54.31	28.62	3.24**	3.97	4.00
	3. Environmental Considerations	16.03	30.86	36.21	3.41**	3.79	3.97
Industry & Economic	4. Levels of General Economic Activity	13.69	30.52	55.86	3.59**	3.83	4.03
	5. Level of Industry Activity	21.21	34.83	43.97	3.55**	3.97	3.83
	6. Industry Structure (Concentration)	19.83	32.24	48.10	3.83	3.83	3.69*
	7. Competitor Analysis	13.10	37.76	49.31	3.45*	3.62*	3.90
	8. Industry Technology	12.93	56.72	26.72	3.17**	3.97	3.90
Accounting	9. Accounting Practices/Disclosures in Industry	35.45	40.97	23.55	3.72*	4.00	3.97
	10. Accounting Standards (General)	39.31	38.28	22.41	3.86	4.00	4.00
	11. Accounting Standards (Industry Specific)	32.24	42.28	25.52	3.62*	4.00	3.90
	12. Current Accounting Issues	32.86	36.55	30.41	3.69*	3.97	3.79
Entity-specific Factors	13. Organisational Structure	10.69	71.72	17.59	3.62**	3.90	3.83
	14. Management Objectives, Philosophies and Strategic Plans	10.52	70.69	18.79	3.62**	3.76*	3.83
	15. Management Strategic Analysis	10.00	71.03	22.41	3.34**	3.76	3.72*
	16. Customer Analysis	10.17	62.93	22.76	3.38**	3.79	3.72*
	17. Supplier Analysis	8.10	42.41	21.90	3.69**	3.79	3.83
	18. Products/Business Processes	21.48	62.86	15.66	3.34**	3.97	3.66*
Auditing	19. Inherent Risks for Industry	34.48	45.69	19.83	3.48**	4.00	3.93
	20. Knowledge of Control Risks and Systems	31.55	52.24	16.21	3.86	3.79	3.86
	21. Auditing Standards (General)	47.76	32.59	19.66	3.79	3.86	4.07
	22. Auditing Standards (Industry Specific)	35.52	36.03	21.55	3.59**	3.93	4.07
	23. Auditing Techniques	41.90	46.38	11.72	3.83	4.10	3.86
	24. Knowledge of Where Errors Frequently Occur	28.45	54.83	16.72	3.48**	4.17	3.97

Table 3
Mean percentages of how current knowledge was acquired and mean ratings of how that knowledge can best be acquired (for entire sample) (continued)

Knowledge category	*Specific knowledge items*	*How current knowledge was acquired (mean %)*			*How further knowledge could best be acquired (mean rating)*		
		Formal Training	*On-the-Job Training*	*Other*	*Formal Training*	*On-the-Job Training*	*Other*
Auditing (continued)	25. Analytical Procedures	26.72	52.59	20.69	3.17**	3.76	3.66*
	26. Knowledge of Expected Relationships Between Account Balances	26.72	58.62	14.66	3.24**	3.90	3.86
Other Knowledge & Skills	27. With Whom to Consult for Identified Problems	13.34	54.14	32.52	3.55**	4.10	3.97
	28. Knowledge to Use Specialised Industry Database Available in Firm	21.72	45.52	32.76	3.03**	3.90	4.00
	29. Client Service Needs	16.03	63.79	20.17	3.52**	3.90	3.83

* = significant at 0.05 **= significant at 0.01 Comparisons against null hypothesis that mean = 4 (appropriate emphasis), where less than 4 indicates too little emphasis and greater than 4 indicates excessive emphasis.

most felt that the formal training was currently appropriate was auditing. The emphasis placed on both 'on-the-job' training and 'other' methods (e.g., research) was considered appropriate for most items. There were two items where it was believed that further on-the-job training could be beneficial: competitor analysis and knowledge of management objectives, philosophies and strategic plans, both of which are major components of the new business risk audit methodology. 'Other' knowledge acquisition methods (research, reading) were considered appropriate for further developing knowledge of five of the 29 knowledge items, including three entity-specific factors: management strategic analysis, customer analysis, and products/business processes.

5. Discussion and summary

The primary aims of this study were to identify the portfolio of knowledge required to be an industry specialist auditor, the current level of knowledge for the items in this portfolio, and how specialist knowledge was and could best be acquired. To address the research questions we utilised a multi-method approach using a free-list task and a survey questionnaire. Participants were experienced audit specialists involved in insurance industry audits from two offices of a Big 4 firm (Boston and Sydney).

Responses under the two research approaches indicated that a broad portfolio of specialist knowledge is needed. For instance, participants frequently noted the need to understand the client's products and business processes, industry activity, and the distribution system used to distribute insurance policies (e.g., agent network used by the client). Further, participants identified the importance of knowing whom to consult on particular issues and being aware of client service needs. Thus the findings suggest that industry specialists bring a broad array of knowledge items to bear on an audit. The results also show few differences in the importance of knowledge items for each industry sub-specialisation. In general, most of the knowledge categories were found to be of equal importance for the sub-specialisations of life insurance, and property and casualty insurance, reflecting a common underlying business model of and audit approach towards insurance entities.

The study also provides evidence on the mechanisms employed to develop industry specialist knowledge. The findings indicate that various mechanisms are utilised. For instance, on-the-job experience appears to be the primary means to obtain knowledge for the categories of regulatory and legal, as well as entity-specific factors, while other methods (e.g., reading and research) are relied upon to obtain knowledge related to industry and economic conditions. Perceived deficiencies in knowledge levels were noted for several knowledge items, including products and business processes and management strategic analysis, and, in particular, greater use of formal training was perceived by the participating industry specialists as being the most effective means to ameliorate these deficiencies. Lastly, more effective firm support systems were perceived by the participating industry specialists to be needed to enhance knowledge in a number of key areas such as entity-specific factors, industry and economic conditions, industry technology, and analytical procedures, with these systems seen as currently placing too great a focus on general accounting and auditing knowledge. The knowledge items for which the industry specialists identified their current level of knowledge as most deficient include some of the items receiving greater audit attention under the newer 'holistic' audit approaches that focus on business risks and strategies (such as the approach outlined by Bell et al. 1997), suggesting greater support is perceived by auditors to be necessary to most effectively implement these approaches.

The findings provide a number of implications for future research and practice. The results suggest specialists possess a broad portfolio of knowledge that is considerably more diverse than that identified and explored in previous research. However, this study did not provide direct evidence on the significance of the various types of knowledge on actual decision performance, an important issue for future research. Further, the research focused on the insurance industry, since it is a well recognised and appropriate specialty within the participating firm. However, similar research in other industry settings would be beneficial to corroborate the extent to which the conclusions drawn from this study are applicable to other industries.

The study also provides evidence on the various mechanisms used by the firm to develop specialist knowledge. Perceived deficiencies in several knowledge items were noted, which auditing firms should consider in order to determine whether additional focus is needed to strengthen knowledge in these areas. Research is also needed to evaluate the cost-effectiveness of alternative means to develop industry knowledge.

In all, the findings serve to highlight the complexity and multi-faceted nature of industry specialisation. Research is evolving to provide a greater understanding of this phenomenon, but much work remains to be done.

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Book review

The Economics and Politics of Accounting: International Perspectives on Research Trends, Policy, and Practice. *Christian Leuz, Dieter Pfaff and Anthony Hopwood (eds.).* Oxford University Press, 2004. xxx + 404 pp. ISBN 0-19- 926062-1

Unshackling Accountants. *D.R. Myddelton.* The Institute of Economic Affairs, 2004. 194 pp. ISBN 0-255-36559-4

The Economics and Politics of Accounting is a collection of 15 essays published as a tribute to the late Dieter Ordelheide, Professor of International Accounting at the JW Goethe University, Frankfurt-am-Main and an outstanding figure in European accounting research and academic life, whose life was very sadly cut short by cancer in May 2000. For me, as for the contributors to this volume, Dieter Ordelheide was a much admired friend, and I share in the great sense of loss (both intellectual and personal) following his death. This excellent book is a richly deserved and fitting memorial. It includes one chapter written by Dieter as the text of a public lecture which he did not live to deliver, and another of which he was a co-author.

After a Foreword by Anthony Hopwood in appreciation of Dieter Ordelheide, and an Introduction and Overview by the three co-editors, the book is divided into three parts, entitled as follows: Part I. On the Economics and Roles of Accounting; Part II. On the Regulation and Enforcement of Accounting; Part III. On the Politics and Standard-Setting of Accounting. In fact, the chapters in Parts I and II are predominantly redolent of 'economics', while the 'politics' appear in Part III. Ten of the 15 chapters, including all of those in Part I, are theoretical in nature.

Part I is subdivided into two sections, both dealing with the roles of financial accounting: 1. Equity Valuation and 2. Performance Measurement and Corporate Governance. In Chapter 1.1, Alfred Wagenhofer sets out to show what we can learn from the use of analytical models in financial accounting and reporting, especially as a basis for problematising 'common sense intuitions' such as 'investors always prefer more information to less'. (Some of these issues receive further examination in Robert Verrechia's chapter in Part II.) In Chapter 1.2, Michael Bromwich addresses the controversial topic of the use of market prices and 'fair values' in financial reports from a 'purely decision-making perspective'. In this chapter, Bromwich sometimes uses 'hedging' when he means 'hedge accounting'. A very interesting counterpoint to Bromwich's analysis is provided by the following Chapter 1.3 by Wolfgang Ballwieser on the limitations of financial reporting. He points out that, following Arrow's choice paradox, 'the individual decision-model is excellent for explaining the concept of decision usefulness, but it cannot advise a financial reporting standard-setter. ... [I]t is not clear what the concept [of decision-usefulness] really means. Decisions may be supported by information about theoretically sound wealth or income measures ... [but these] are not well-defined in a world with incomplete and imperfect markets'.

In Chapter 2.1, Dieter Pfaff addresses the issue of whether, for performance measurement, accrual-based contracts (for example, with residual income measures) are preferable to measures based on realised cash flows. He asks 'why, in practice, are certain contracting problems dealt with by using the performance measure while others are addressed in the compensation function?' and points out that recent research suffers from a failure to separate performance measures and compensation functions. The following Chapter 2.2 is a case study by Ray Ball on the relation between corporate governance and financial reporting at Daimler-Chrysler. The chapter is very interesting, but some of its conclusions contain value-judgements that are debatable. Ball is an unashamed neo-liberal who does not hesitate to assert that the neo-corporatist 'stakeholder' model of corporate governance employed by Daimler-Benz prior to the merger with Chrysler is 'poor' because it 'focuses more on dividing the pie rather than maximizing the pie'. But neo-corporatist corporate governance does not inevitably lead to the lack of transparency that characterised German financial reporting, nor to a failure to 'maximize the pie' (historically, firms in the post-1945 West German economy performed rather well). The problems of accountability that the neo-corporatist model raises in a global economy are not so much related to financial reporting, but rather concern its roots in the nation-state and the obstacles to the extension f accountability to stakeholders (especially those *ther than* shareholders and lenders) beyond the ation-state's boundaries.

Part II also contains two sections (3 and 4). The rst of these concerns the regulation of disclosure, d the second the enforcement of accounting andards. In Chapter 3.1, Robert Verrecchia disusses policy implications for disclosure standards f the theory-based literature. He is especially conerned to distinguish between: (a) analyses primaly concerned with 'narrow pathologies' and emingly perverse economic behaviours and movations; and (b) notions that originate from the eory-based literature that are supported by casul empiricism. Thus, he 'debate[s] the utility of arious theories based on the existence of real-orld phenomena that comport with the theory'). 150). This chapter provides a counterpoint to e earlier analytical chapter by Wagenhofer. errecchia is particularly concerned to examine rguments as to why policy makers should not lly round the highest disclosure standards, and ctors alleged to prevent firms from disclosing oluntarily. He makes the interesting suggestion at managers seem to behave on the basis of euristic ideas as to how disclosures will be used euristically) in market settings. Chapter 3.2 by hristian Leuz presents an empirical study of dislosure in Germany designed to test the 'propritary costs' hypothesis, by examining the trade-off etween capital-market benefits and proprietary osts in firms' choices of voluntary disclosures. He nds that while peer pressures in international capal markets can be strong enough to outweigh prorietary costs, policy makers cannot rely on this nce proprietary costs remain an important reason hy fuller disclosure does not prevail (see also the onclusions to Chapter 4.2 below).

In chapter 4.1, Walther Busse von Colbe presnts a critique of the 'impairment-only' approach) accounting for goodwill (i.e. the abandonment f goodwill amortization) in the context of finanial reporting in Germany. He finds the abandonent of goodwill amortization to be both nnecessary and unconvincing. In particular, he oints out that even if goodwill amortization is igored by capital market participants, this does not onstitute a cogent argument against it, since if very item in group accounts that is of little interst to analysts is omitted, financial reporting would ave so many holes that it would lose at least part f its information content' (p. 214). Chapter 4.2 is n empirical paper by Günther Gebhardt and aron Heilmann on German firms' compliance ith accounting standards on cash flow stateents. They find that not merely do many German rms fail to comply fully with the accounting stanard which they claim to be applying, be it the erman standard GAS 2, IAS 7 or FAS 95, but also not a single audit opinion on the financial statements of the sample firms included a qualification in respect on such non-compliance. Their suggested explanation for the preparers' behaviour is that the proprietary costs of full compliance outweigh the perceived capital market benefits. However, this does not explain the failure of auditors to perform their role.

In Chapter 4.3, Ralf Ewert presents a paper dealing with the issue of non-audit services (NAS) and their effects on audit quality, in theoretical terms accompanied by a review of recent empirical papers. The conclusions challenge the conventional wisdom (now reflected in regulatory provisions in several countries) that the provision of NAS to an audit client impairs audit quality. Even if NAS provision might decrease auditor independence, Ewert finds that there is strong theoretical and empirical evidence that it may on balance be beneficial for the final quality of both the audit and the audited financial statements. The main theoretical reason for this lies in the effects of economies of scope (to both auditor and client) or 'knowledge spillovers' resulting from the provision of both audit and NAS to a client.

Part III of the book is very much concerned with the 'politics of accounting', comprising Section 5 on the role of accounting in society and constituent lobbying, and Section 6 on standard-setting processes and international accounting standards. Chapter 5.1 is the draft of a P. D. Leake Lecture that Dieter Ordelheide was due to give at Oxford University in 2000, which he did not live to give. It presents a framework for theorising the politics of accounting, seen as a social institution constructed by virtue of collective intentionality (to use John Searle's term – see also Alexander and Archer, 2003). It is followed by two empirical chapters. Chapter 5.2 was co-authored by Stuart McLeay, Dieter Ordelheide and Stuart Young. It deals with constituent lobbying of the German Federal Legislature, as the accounting regulator in Germany, with regard to the enactment of the Fourth Directive into German law. A particularly interesting finding is that, while the industry lobby was the most effective of the three categories of lobbyist (the others being auditors and academics), industry lobbying was not very successful on an issue unless its proposal was supported by at least one of the other categories.

In Chapter 5.3, Stuart McLeay and Doris Merkl bring a somewhat similar analysis to bear on the process of re-drafting accounting law in Austria in preparation for that country's membership of the EU. The lobbyists were divided into three categories: employers, employees and experts. The average success rate for proposals was 54%, but was 65% when more than one lobbyist were in agreement and only 37% in the case of disagreement.

In Chapter 6.1, Karel van Hulle provides a knowledgeable account of the process (the two-stage 'endorsement mechanism') whereby International Financial Reporting Standards are to be incorporated into EU law for application to the consolidated financial statements of listed companies. The first stage of the mechanism is technical in nature, while the second stage is political. The chapter was written before the problems over the second (political) stage of the endorsement of IAS 39 came to a head. However, as van Hulle notes: 'There is always the risk that the concept of European public good [one of the three political endorsement criteria] might be used as an excuse for not endorsing a standard that European stakeholders do not want for various reasons' (p. 369). I look forward to reading a study of constituent lobbying of the Accounting Regulatory Committee (the body that advises the EU Commission in the political stage of the endorsement process) over IAS 39. Chapter 6.2 by Michael Power is a comparative study of the role of academics in the accounting rule-making process in Germany and England and Wales (Scotland being excluded as different from the latter). Power develops a triangular model of 'intellectual space' with three poles: Law, Economics and Practice. What is somewhat puzzling is that the position of most German academics is near to the Law pole, in spite of the existence in Germany of a 'business economics' tradition that is largely lacking in the UK. Power explains this, at least in part, by pointing out that the existence and advocacy of economic based theory of accounting measurement in Germany did not lead to its adoption in practice.

Taken as a whole, this book is a rich source of ideas and findings which can be recommended as enjoyable as well as instructive reading for researchers in the financial accounting field. In particular, it will help in identifying research hypotheses.

The book by David Myddelton provides a striking contrast in terms of style and purpose. The publisher, The Institute of Economic Affairs, is a UK 'think tank' with marked neo-liberal tendencies, and the book (published as one of its Hobart Papers) is essentially a neo-liberal polemic against what Myddelton perceives as the gross over-regulation of financial reporting. It is an updated version of his earlier Hobart Paper *Accountants without Standards*? In Chapters 4 and 5 he examines a number of arguments for and against (mandatory) accounting standards. However, he does not appear to recognise that the arguments may differ for disclosure standards on the one hand and standards for recognition and measurement on the other. In any event, his arguments against mandatory accounting standards seem to be mainly directed against the latter. These arguments are presented under four headings:

- Stifling or forbidding independent judgement by accountants;
- Reducing competition in ideas and stopping or distorting evolution and experiment;
- Legitimising bad accounting (and sometimes forbidding good accounting);
- Misleading the public by unduly raising expectations.

With regard to the first heading, while one may sympathise with David Myddelton's intellectual frustration over the proliferation of ever more detailed financial reporting standards dealing with recognition and measurement in the absence (so far) of any clear theoretical basis, his notion that judgments about appropriate accounting treatments can be made on the basis of professional intuition as to what constitutes a 'true and fair view' or 'faithful representation' fails to take account of the ontology of accounting and the essential role of rules in accounting representations. The objects of accounting are (as Dieter Ordelheide pointed out in his Chapter 5.1 mentioned above) intersubjective constructions that exist (are real) by virtue of collective intentionality. Such a view of professional intuition and its possibilities seems to suppose that it involves 'privileged and unproblematic access to some underlying observer-independent reality' (Shapiro, 1998: 30; see also Alexander and Archer (2003: 9). But accounting reality is not like that.

With respect to the second heading, Myddelton fails to distinguish between law-based accounting standards and those promulgated by a private-sector body following a 'due process' of consultation in reaching a consensus. He does not produce any convincing arguments that the latter are not open to 'competition in ideas and innovation'. A more telling criticism may be levelled under the third heading: the standard-setting process may 'legitimise' messy compromises such as the hedge accounting approach in IAS 39 which has proven to be so troublesome. As regards the undue raising of expectations, it is not clear whose expectations are being unduly raised.

If Myddelton wishes to mount an offensive against mandatory accounting standards that is intellectually cogent rather than rhetorical, he will need to base his arguments on an analysis that takes account of (a) the ontology of accounting and of the role of rules in that ontology, and (b) theoretical and empirical results regarding the economics of accounting regulation. The chapters by Wagenhofer, Ballwieser, Verrecchia, Leuz and Ordelheide in the book reviewed above might give him some useful ideas. This is not to say that professional accounting judgment does not have a key ɔle in financial reporting and auditing; but I have rgued that that role lies in applying the *spirit of a* *ɜt of accounting rules* intended to lead to non-ıisleading financial statements. For this, the set of ıles needs to exist (Alexander and Archer, loc. cit.).

ſniversity of Surrey Simon Archer

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The costs and benefits of increased accounting regulation: a case study of Lloyd's of London

An investigation into the measurement of graph distortion in financial reports

Why do executives serve as non-executives? Pre-Cadbury evidence from UK non-financial companies

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Audit and control in the not-for-profit sector: an endowed charity case 1739–1853

Mae Baker and Michael Collins*

Abstract—This paper reports on an investigation of an endowed charity, the Lady Elizabeth Hastings Trust, over the period 1739 to 1853. This period pre-dated the establishment of the permanent Board of Charity Commissioners, and was one in which the legal regulatory framework offered the trust's beneficiaries only limited redress against abuse by the managers of the trust. The safeguarding of the beneficiaries' interests depended heavily on the governance and control structures established by the trust's dead benefactress. Examination of the trust's Deed of Settlement, the accounting records and audit statements, show that from its inception this not-for-profit organisation employed a system of separation of powers, internal audit with documentary audit trail, and notably, an independent audit. The paper highlights the 'progressive' nature of the auditing mechanism adopted by this not-for-profit organisation, even when compared to the commercial sector of the period. Archival evidence is used to show that the governance system put in place by the foundress of the trust was successful in overcoming agency problems, in detecting abuse by the agents, and in ensuring the compliance of the agents with the wishes of the benefactress for more than a century after the benefactress's death in 1739. It is suggested that examination of the not-for-profit sector, so far largely ignored in the history of audit, can yield valuable insights into the development of auditing in the UK.

> 'Without audit, no accountability; without accountability, no control; and if there is no control, where is the seat of power?' (Flint, 1971:288)

1. Introduction

Historical studies of the development of the auditing function prior to the 20th century have been concerned almost exclusively with its use in business organisations; and more especially – within the historical context – with its role within the evolving governance structures associated with the modern joint-stock enterprise. In that respect this article is somewhat novel in that it is concerned with the use of audit in the not-for-profit making sector. Prior to the 20th century, the charitable sector was important in the provision of social services (including education, healthcare and care for the elderly) and, therefore, a study of the governance and control mechanisms adopted in the sector is of significance. A number of noteworthy studies focussing on the not-for-profit sector have been conducted: such as those of Cherry (1992) and Berry (1997) which analyse the funding and expenditure of subscription hospitals; Lacombe-Saboly (1997) which examines the accounting practices of French 'mixed-funded' hospitals from the 17th to the 19th centuries; and Edwards and Chandler (2001) which examines the social, economic, political and philosophical factors at work in the statutory regulation of British friendly societies. We have not, however, been able to locate any serious studies of the auditing of endowed charities in this period. Swanson and Gardner (1988) provide a substantial study of the audit of a contemporary charitable organisation, the Society for Propagating the Gospel in Foreign Parts, but, this Society was a subscription charity (reliant upon members' subscriptions and donations) and, therefore, it differed fundamentally from an endowed charity (see below).

The approach we adopt in this article is to present an important early case study, that of the Lady Hastings Trust, for the period 1739–1853.[1]

The case provides a fascinating insight into the central role played by an independent audit in the verification, monitoring and control processes of an organisation whose functions had been strictly

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*The authors are at the University of Leeds. They wish to express their gratitude to the Institute of Chartered Accountants of Scotland, whose financial support made possible the examination of the archives and collection of data for this project. They are also grateful for the careful and helpful suggestions of anonymous referees. Correspondence should be addressed to Dr Mae Baker, Leeds University Business School, University of Leeds, Leeds LS2 9JT. Tel: 0113 3432644; E-mail: mb@lubs.leeds.ac.uk

The final version of this paper was accepted in November 2004.

[1] This study builds upon previous work by Baker (1997) and Baker and Collins (2002). Baker (1997) deals primarily with Lady Hastings as a renowned figure in the field of education reform, especially with regard to the provision of free primary education and the education of females. It concentrates upon provisions made for the care and education of girls in one particular Yorkshire orphanage. Baker and Collins (2002) analyse governance weaknesses revealed in the operation of the full range of endowed West Riding charities examined by the Charity Commissioners in the late 19th century.

stipulated, and whose total resources had been wholly provided by a benefactress who was deceased and, therefore, unable to exercise control personally.

The article is organised in the following manner. First, a brief discussion of the history of audit in England and Wales in order to provide context for our case study, and to highlight the significance of the case. The second issue we address is that of the nature of governance problems facing the management of endowed charities. Some of those problems arose from the legal and regulatory framework of the 18th and early 19th centuries but, more fundamentally, we argue that the problems are best seen within the context of a principal-agent framework, albeit one modified by aspects of a common bond of trust shared by various levels of agent and principal. We then introduce the case study, concentrating on the governance structure that was in operation and emphasising the central role of audit. In the last substantive section, historical evidence is presented on the effectiveness of the trust's control mechanisms. There is, then, a brief recapping of our main findings and consideration of the potential contribution which study of not-for-profit organisations could make to the history of audit.

2. A selective history of audit

In this section we survey the literature on the history of auditing in a very selective fashion, concentrating, first, on the emergence of audits of landed estates and, then, on the rarity of independent audits of businesses even during the 19th century. Both these aspects of English auditing history provide important contexts for an assessment of the operation of the Lady Hastings Trust in the 18th and early 19th centuries.

The English origins of the modern audit function, it is generally agreed, lie in the verification of public accounts – the Exchequer Accounts, Borough Accounts, and accounts of public bodies such as the Guilds. In the medieval period, the practice of audit seems to have been adopted by commercial ventures (Watts and Zimmerman, 1983:614), manors and landed estates, as merchants and the nobility increasingly copied the mechanisms for accountability within public authority accounts (Brown, 1905:50). There is general agreement, too, that the need for audit arose from the emergence of the agency problem (Brown, 1905:53–4; Brown, 1962:697–8; Chatfield, 1977:20; Matthews et al., 1998:98; Watts and Zimmerman, 1983:630).[2] 'The characteristic accounting problem [in feudal society] was one of vertical communication and verification between principal and agent' (Chatfield, 1977:20). It is clear from a range of historical studies that where one or more individuals (the agents) were entrusted with the safekeeping or management of the property of others (the principals) then questions of honesty, integrity and competence arose. In the absence of a bond of trust as might exist within families, the need for a mechanism of accountability was a concern:

> 'Whenever the advance of civilisation brought about the necessity of one man being entrusted to some extent with the property of another the advisability of some kind of check upon the fidelity of the former would become apparent. (Brown, 1905:75)

Basic was the idea that men in positions of trust should be subject to public scrutiny. Corollary was the notion that expectation of audit made such stewards more honest. (Chatfield, 1977:112)

From the 13th century onwards, on English landed estates chamberlains, stewards and bailiffs were held to account to their masters – be it a sovereign, or a lord of the manor – for the property entrusted to their safekeeping and management (normally employing charge and discharge accounting); for the collection of revenues due to the master and expenditures made on his behalf; and for the balance to be handed back to the master. The purpose of those early audits was to verify the accuracy of the reported transactions, and to test the honesty of the agent, with detection of fraud (and the corollary, the prevention of fraud) being an essential part of the audit. Indeed, from the time of Edward I in the 13th century, the importance of verification of bailiffs' accounts was not only recognised, but accompanied by a statutory penalty of imprisonment if a bailiff, upon audit, was found to have transgressed against his lord. Brown argued that 'from the fourteenth century onwards we have ample evidence that the advisability of having accounts audited was widely recognised' (Brown, 1905:78). The process was taken seriously, with documented cases of payments disallowed and of refusals by auditors to certify accounts because of omissions.

These early audits consisted of verbal accounts given by the agent (bailiff) and questioning of the bailiff, often by a third party (an audit official appointed by the master) whose purpose was to examine the bailiff (Littleton and Zimmerman, 1962:104). The 'auditor' clearly held a position of superiority over the bailiff. Thus, Brown (1905:77) has drawn attention to a 13th-century treatise on estate management[3] which instructs that the bailiff should attend the examination of the accounts with the auditors but should be 'subordinate as having to answer to the auditors on the account of his doings.' The progress from verbal account-giving to written accounts (typically charge and discharge statements in the case of estate accounting) did not alter the fundamental nature of the audit as a test of the agent's integrity:

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[2] For similar concerns in later periods, see among others, Bryer (2000).

[3] Oschinsky (1971) and Scorgie (1997) provide analyses of treatises on estate management from medieval times. Clay (1985 ch. 14) provides a more general discussion of estate management.

> 'Early audit tested the personal integrity of stewards, not the quality of their accounts. Proof of book-keeping accuracy and fairness were sought only insofar as they might indicate the existence of fraud.' (Chatfield, 1977:112)

It is clear from this brief survey that the use of audits on English landed estates was well established by the 18th century. It is perhaps not surprising, therefore, that the Lady Hastings Trust, whose assets consisted solely of a landed estate and associated real estate,[4] should have been subject to audit. The more remarkable feature of the governance of the trust is that the use of audit was not confined to the management of the estate properties but was also extended to all its activities, to the disbursement of charitable expenditure and to its management of schools and an orphanage.

The second feature in the history of auditing relevant to the current study is the extent to which independent audits were rarely performed, even by the close of our period. For example, according to Swanson and Gardner (1988), the Society for Propagating the Gospel in Foreign Parts used a group of auditors internally elected from the membership; an arrangement which Swanson and Gardner claim was similar to that described by Watts and Zimmerman as used in commercial ventures during the early 18th century. Indeed, Swanson and Gardner state that the auditing practices of the Society 'were adapted from commercial audit procedures' (1988:444).

It was the emergence in Britain from the second quarter of the 19th century of a more extensive capital market for private sector assets and the associated adoption of the joint-stock company structure that eventually gave rise to more extensive financial reporting and auditing, largely as a means of protecting shareholders' interests (Cottrell, 1980; Alborn, 1998). Thus, railway companies established in the 1830s and 1840s appear to have used audits frequently. Even so, Parker (1990) claims that (in the railways, public utilities and financial institutions sector during the second half of the 19th century) 'there was little conception of the auditor as an independent third party. An audit was still usually regarded as an examination by a public or private body into its own affairs and it was normally taken for granted that it should be carried out by interested parties' (1990:67). In other areas where the corporate structure was adopted in the early part of the 19th century audits seem to have been unusual. For instance, a Parliamentary enquiry of 1836 found that of 107 joint stock banks investigated, only nine used auditors (Cooper, 1886:33). Indeed, it was not until the Joint Stock Companies Act of 1844 that an attempt was made to introduce compulsory audits of annual balance sheets for those companies registering under the legislation. Even so, such auditing stipulations lacked rigour and the auditing function so established was generally unsatisfactory. Moreover, it was not the intention of the 1844 legislation to allow for the appointment of independent auditors, but rather to allow shareholders' representatives to check the annual balance sheet. 'Some of the contemporary literature does in fact suggest that many auditors merely carried out a "mechanical" audit which comprised a comparison of balance sheet figures with the totals appearing in the company's books. .... the small amount of time allowed the auditor...would allow only a superficial examination...' (Edwards and Webb, 1985:191). The legal requirement for even this weak audit was to be removed by a new Joint Stock Companies Act of 1856. It was only specific categories of companies such as those companies registered under the Railway Companies Act of 1867 and banks under the Companies Act of 1879 (following the City of Glasgow bank failure) that were subject to compulsory audit requirements.

In the case of the bank auditors appointed under the 1879 legislation, they may have been external to the organisation but they were far from independent because they were still appointed by the bank directors, and the audits conducted continued to be superficial (Walker, 1998:50). Indeed, the legislation of 1875 and 1876 relating to the audit of friendly societies and industrial and provident societies was considerably more demanding than the 'superficiality of the audit' contained in the Companies Act of 1879 (Walker, 1998:50). Thus, it was not until the Companies Act of 1900 that a general legal obligation was imposed for annual audits by registered companies.

Legal stipulations apart, Kitchen (1982:26) believes that, '...auditing [only] became significant for the generality of firms and companies mainly from the last quarter of the 19th century...' In his assessment of the evidence, Hein believes that prior to the Companies Act of 1844, in those selective activities where some companies did use auditors (rail, utility, insurance and banking companies), 'there is little indication that the auditors were selected on the basis of their aptitude for the position' (1963:508). In fact, the quality of audits in general was questionable, especially prior to the professionalisation of accounting towards the end of the century. Robb is dismissive of the amateurishness of contemporary audits, referring to them as 'biscuits and sherry' audits, all agreed over pleasant refreshments (1992:99). In fact, it was not until 1885 that legislation first stipulated that auditors should be qualified accountants,[5] although only in the specific case of audits of asylums under the Lunacy Act of 1885 (Cooper, 1886:33).

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[4] In 1739 the Trust estate comprised approximately 1,274 acres of agricultural land which included eight farms, three small-holdings, 10 cottages, a water-driven corn mill and chief-rents from 13 farms plus a further 84 acres of woodland. In addition to this revenue producing real estate there were also the school buildings, school-masters' houses, the orphanage with extensive outbuildings, and the land associated with the schools.

To anticipate one of our major findings, on the basis of the above survey it would appear that compared even to the business sector in the first half of the 19th century, the auditing arrangements for the Lady Hastings Trust during the 18th century were extremely progressive.

3. Governance of charitable trusts, 1700–1853

One important historical peculiarity of the agency problem which has received little scholarly attention is the question of what happened where, within a principal-agent framework, the principal was deceased. This was the problem faced by founders of the endowed charities that provided a significant proportion of welfare services prior to the 20th century. The financing of charitable organisations during the 18th and 19th centuries was mainly by subscriptions or endowment. The latter organisations faced their own particular accountability and control issues. Endowed charities were founded with a donation of assets sufficient to generate an income to support the charity, whereas subscription charities were funded on an ongoing basis by raising 'subscriptions' or donations throughout the organisation's life (many of the early hospitals,[6] for example, were subscription charities). Endowed charities would have faced a greater agency problem than those funded by current subscriptions. In particular, for voluntary subscription charities donors were normally still alive and, therefore, capable of holding the managers of the charities to account.

In the case of endowed charities, however, the benefactor or benefactress was almost certainly dead, and obviously was in no position to question the use of the assets donated (usually bequeathed). In England and Wales, the legal enforcement mechanism relating to endowments was weak, certainly up until – and, in fact, even after – the establishment of the permanent Charity Commissioners in 1853. At the time that the Lady Hastings Trust was set up, and throughout the first century or so of its operation, complainants seeking redress in the matter of alleged mal-administration of charitable trusts had only one option – to bring a case in the Court of Chancery, a process fraught with difficulties, long delays, excessive costs and no guarantee of a satisfactory outcome (Tompson, 1979).[7] The situation had not improved by the mid-19th century, as Dickens reminds us in *Bleak House*. Indeed, Dickens was drawing upon his own experience as a boy-clerk to an attorney, and states in the preface:

> '...that everything set forth in these pages concerning the Court of Chancery is substantially true, and within the truth....At the present moment there is a suit before the Court which was commenced nearly twenty years ago; in which from thirty to forty counsel have been known to appear at one time; in which costs have been incurred to the amount of seventy thousand pounds; which is a *friendly suit*; and which is (I am assured) no nearer to its termination now than when it was begun.' (Dickens, 1853:7)

Dickens claimed that the case was not unusual, and cited another which had commenced before the end of the 18th century and which by the 1850s had already swallowed up over £140,000 in costs. In fact, there was no lack of real examples with which to bolster his fictional portrayal of Jarndyce v Jarndyce. Jeremy Bentham (1843) and Anthony

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[5] Walker (1993) conducts a comprehensive analysis of the importance of various income sources, including audit work, to Lindsay, Jamieson and Haldane, a major Edinburgh firm of Chartered Accountants, between 1818–1918. Examination of trust deeds (where Lindsay, Jamieson and Haldane acted as trustees) revealed that although half contained provision for audit, before the late 1870s neither the frequency of audit nor the auditor were specified (Walker, 1993:146).

[6] In the period covered here the term hospital was generally used to mean almshouse; however, in order to avoid confusion the term hospital in this paper is used to refer to infirmaries.

[7] The law relating to charitable trusts was codified by the Statute of Charitable Uses of 1601, in the reign of Elizabeth I. This empowered the Lord Chancellor to constitute a commission to enquire and decree findings in cases of mismanagement or abuse of a charitable trust. Thus redress at law for a charitable trust meant recourse to the Court of Chancery. Decisions reached by the Court of Chancery formed the case law in Equity pertinent to charitable trusts. There was no significant legislative change to the laws relating to such charities until the Statute of Mortmain in 1736, which restricted devises of land but did not otherwise alter matters. During the latter half of the 18th century, a number of local acts attempted to sequester charitable funds left for the poor in order to apply them under a general local authority for the benefit of the poor or relief of the poor rate. With the establishment of the permanent Charity Commissioners in 1853, the Commissioners applied consolidatory measures to amalgamate numerous small charities in a locality. A comprehensive summary of the development of the laws relating to charities can be found in Jones (1969). Discussion of the impingement of other legislation upon charitable trusts (for example the Land Tax) is provided in Tompson (1979: ch. 2). 19th-century texts on the law relating to charitable trusts are: Gilbert (1811), Parkes (1828), Lewin (1842), and Marsh (1890).

Trollope (1855) were two other powerful contemporary critics of the inefficiency and ineffectiveness of the Court of Chancery. Significantly, the Court of Chancery recouped the costs of any actions from the assets of the charity involved, an effective deterrent in most cases. The ineffectiveness of the law in detecting and correcting any maladministration was particularly poignant in the case of charitable trusts, where by their very nature, the poverty, lack of education, and political impotence of the intended beneficiaries meant that they had no voice in the operation of those charities. Redress at law was available in principle, but was not a practical option for intended beneficiaries during the 18th and 19th centuries.

It is within this context that the accounting information and control structures established by the dead 'principal' (i.e. the benefactor/ess) were critical to the continued good working of endowed charities over a very long period. Endowing a charity with assets required the vesting of the legal ownership of the assets in a body of trustees. As we have argued, the fact that the original benefactor/ess is dead creates a peculiar, if not unique, set of principal-agent problems. In an important sense the benefactor/ess remains a 'principal' in the relationship (even if deceased) in that it was he/she who created the charity in the first place; it was he/she who delegated control over the disposal of resources to the agents responsible for managing the trust; it was he/she who specified both the trust's and agents' functions and responsibilities; and it was he/she who determined any accounting, control and monitoring structures. However, once the benefactor/ess had arranged the legal transfer of assets to the charitable trust, he/she ceased to be the legal owner of those assets and the main stakeholders of the charity became those beneficiaries for whom the charity's handouts were intended.

Importantly in the 18th and 19th centuries, in general the main beneficiaries of the charities were the poor, inarticulate and politically impotent (Baker and Collins, 2002). These were recipients of 'doles' of cash or clothing, free education, free housing for the elderly, scholarships, and the like. Overwhelmingly, they were passive recipients of charity, expected to be grateful, and they played no part in the operation of the trusts. In other words, the monitoring capabilities of the trusts' main stakeholders – the beneficiaries – were largely non-existent. In these circumstances, the interests of the beneficiaries in the trust became virtually identical to those interests as laid down by benefactor/ess. In this sense, it is useful, within a principal-agent relationship, to view the benefactor/ess as the principal *in absentia* and, most significantly, it was the robustness of the controls that were imposed by the benefactor/ess to avoid abuse and misuse of the charity's assets that was critical to safeguarding the interests of the beneficiaries.

With long-lasting trusts, death also impacted upon the agency function. Thus, one problem with appointing individuals as trustees is their inevitable demise. One solution historically was to appoint individuals 'and their heirs' – so that trusteeship passed through the generations. Another was to appoint as trustee the holder of a perpetual office (for example, a bishop) or an institution (such as an ancient City Guild). These 'solutions', however, could pose their own problems in that later generations of heirs may not feel the same obligation as their forebears to discharge their duties as trustees. Holders of an office or (more frequently) an institution – such as an Oxford or Cambridge college – may be distant geographically and may lack vigour in the ethical discharge of their duties. All such problems could give rise to agency difficulties resulting in opportunities for abuse of the charitable endowment. It could also be important to an effective endowment to separate the roles of trustee (in whom legal ownership of the endowment is vested) from control of resources, in order to minimise conflicts of interests and reduce the dangers of abuse from trustees either claiming personal ownership of the endowment or simply using it for their personal benefit.

Dangers of 'abuse' during the 18th and 19th centuries, and earlier, were real enough. The Charity Commissioners' enquiries of the 19th century report many such abuses (among many such reports see *British Parliamentary Papers*, 1894, vol. LXIV; 1899, vol. LXXIII). Those enquiries are the most extensive available and they take a retrospective approach, thus providing chronologies of trusts' activities over long periods. Two specific contemporary examples from Yorkshire give some indication of the type of abuses that could arise.

Normanton Grammar School Foundation dated from a substantial bequest of 1594 under which a geographically remote institution, University College, Oxford, was appointed both trustee and manager. The bequest was to provide for the building and running of a free grammar school in Normanton, the provision of scholarships to University College for boys of Normanton Grammar School and for financial support of University College. However, negligent self-interest resulted in a flagrant misuse of the endowment, to the benefit of the trustees. Over the years, the trustees continued to collect the revenues of the bequeathed estate but failed to apply them in accordance with the benefactor's instructions, very much to the detriment of the Grammar School at Normanton. Some 270 years after the foundation of the trust, the trustees were found to be keeping all but a paltry sum for themselves (University

College) instead of using one-half of the revenues for the maintenance of the school, as stipulated in the original deed. In this case, the benefactor's intentions had been well and truly thwarted – the grammar school became a dysfunctional elementary school which was forced to close in the 19th century. Subsequently, it was to be rescued by the Charity Commissioners, who successfully negotiated financial restitution from University College (*British Parliamentary Papers*, 1899, vol. LXXI-II:302–3, 306–22).

A similar example of abuse by agents who were both trustees and managers concerns the endowment by Mary Ramsden of her West Riding estate in 1743 for the provision of schooling for poor children. An investigation by Charity Commissioners in 1825 (at that time an ad hoc, temporary group) revealed that not only had schooling never been provided, but also that the endowment had found its way into the personal estate of the last surviving trustee and had been shared amongst his seven children on his death in 1789 (*British Parliamentary Papers*, 1899, vol. LXXIII:20–21, 28–31). Abuses of this kind led to growing pressure for reform from the late 18th century, although a permanent regulatory framework was not established until the Charitable Trusts Act, 1853 created the Board of Charity Commissioners (Tompson, 1979).

Within a weak official regulatory framework of the sort we have outlined, internal control mechanisms and informal bonds of trust were paramount. As in most durable principal-agent arrangements, protection of the interests of the principal (whether benefactress or intended beneficiaries) was dependent on the efficacy of the formal arrangements for the monitoring and control of agents and on the honesty and trustworthiness of the chosen agents. Our focus is on the former, but it is relevant here to comment briefly on the latter.

A growing body of literature has stressed the importance of trust-based relationships to the successful execution of contracts (Luhmann, 1984; Zucker, 1986; Lane and Bachmann, 1996; Coleman, 1990; Armstrong, 1991; Broadbent et al., 1996; Laughlin, 1990). Most of these studies recognise the limitations to the use of legal stipulations for resolving principal-agent frictions and stress the importance of social institutions and social relationships in ensuring the fulfilment of contracts.[8] In this context, the faithful execution of the intentions of a benefactress such as Lady Hastings, and the safeguarding of the interests of the main beneficiaries of her endowment – that is, the poor who were to receive free education – depended not only on contractual arrangements but also upon the degree to which the benefactress' trust in her chosen agents was justified. This, in turn, depended on the integrity and probity of the appointed trustees and other agents responsible for administering the charity after her death. It is for this reason that Lady Hastings relied upon the clergy to execute her wishes. For a woman with a strong Protestant faith, it would have been an obvious choice, and the pervading ethos of the clergy as a whole, with its overt emphases on charity, honesty and godliness, would have helped militate against the possibility that, some time in the future, the self-interest of the appointed agents might override the wishes of the principal(s). There would also have been an external social dimension. The fact that the status of clergymen amongst their peers and the broader community was heavily dependent on their reputation for integrity and trustworthiness would have reinforced any genuine conformity to the 'higher morality' in which Lady Hastings believed. As Armstrong (1991:16) has noted, one contingency available to principals in ensuring conformity to contractual arrangements 'is the employment of professionals...who represent themselves as committed to act on certain ethical and technical standards. While these will not ordinarily coincide exactly with the interests of the principals, they will at least have the virtue of predictability, insofar as the standards are actually adhered to.' Today, such professionals may well be accountants or lawyers but, in the early 18th century, for Lady Hastings the clergy seemed to offer such general safeguards.

Even so, although the established spiritual norms of behaviour for the clergy offered an appropriate moral framework in which the Lady Hastings Charity could be managed, conflicts of interests and sins of commission or omission were always possible in the real world. For this reason, Lady Hastings also devised a system of monitoring and accountability. It is on these formal arrangements that the rest of this article concentrates.

4. The Lady Hastings Trust

The case study presented here concerns an endowed educational charitable organisation which has survived in the West Riding since its inception in 1739, due, in part, to the effectiveness of the prescribed control mechanisms put in place by the foundress, Lady Elizabeth Hastings. Those mechanisms helped ensure that her wishes were carried out long after her death in 1739, because – in the words of Lamb – they allowed for the 'extension of power beyond the scope of surveillance capability' (Lamb, 2001:278). This particular case is chosen for a number of reasons. The first is its obvious success in surviving. The Trust is still operational today, over 260 years later.[9] The second consideration is the survival of accounting (and other) records for the whole of the Trust's existence. The extent of these records enables us to examine both the role of the auditing function and the part played by societal influence in the implementation of control mechanisms. We are particularly interested in the effectiveness of the Trust's established auditing and control mechanisms as they operated in a largely non-regulated environment, prior to the creation of the permanent Board of Charity Commissioners in 1853.

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[8] An interesting historical study which highlights the effect of trust in reducing monitoring costs is that of Rodger (2001) which examines how the trusts established in Edinburgh during the 19th century to oversee the administration of legacies, contributed to the development of the built environment through investment in property.

The Lady Hastings Trust was set up under the will of Lady Elizabeth Hastings of Ledstone Hall, Yorkshire. She was born in 1682, the eldest daughter of the seventh Earl of Huntingdon. Lady Hastings was co-heir with her brother George (subsequently the eighth Earl of Huntingdon) to the estates of her grandfather, Sir John Lewis, baronet, entailed to them through her mother. In 1704 she became sole heir at the age of 22 when her brother died unmarried. Lady Hastings was a wealthy member of the land-owning aristocracy. She did not marry, although this was not for lack of suitors (Hastings Wheler, 1935:43–4). We can only speculate about the reasons, but one consideration may have been a desire to retain complete control over her wealth and the disposition of it. Her entry in *Who's Who in British History* (Gardiner, 2000:397) hints at her extensive religious and charitable interests:

> '...intellectual and philanthropist...Lady Elizabeth used her wealth to promote the scheme of her friend Mary Astell for a religious and intellectual retreat for women. Her educational charities included George Berkley's proposed college in Bermuda. She also helped provide an environment for the development of Methodism through her support for the young John Wesley and for her half-sister Margaret's marriage to the Methodist Benjamin Ingham. These contacts helped set the scene for the Evangelical conversion of her half-brother's wife Selina Hastings, Countess of Huntingdon.'

Throughout her life she was a constant and generous benefactress of the poor and underprivileged, with a particular interest in the education of the poor. She established several charity schools in the British Isles, and supported many more, but her particular concern was for the education of the poor in the Yorkshire manors which she owned (Baker, 1997). By contemporary standards, the Lady Hastings Trust operated on a large scale. Its endowments provided complete support of five schools, including the maintenance of the fabric of the buildings. In addition, the endowment maintained an orphanage which involved the full financial support for twenty girls, resident mistress and maid, and pension provision for the mistress upon retirement. There was also additional part support for a further six charity schools, almshouses, several churches, and provision for numerous donations.

One of Lady Hastings' main concerns was to ensure that the charity schools she set up had sufficient resources to continue after her death. However, the rising tide of anti-clerical feeling during the early Hanoverian period, was combined with the fear of the wealth of the Church and of the large ecclesiastical charities such as Queen Anne's Bounty. This bred alarm in England that such charities would absorb estate after estate – to the ruin of the landed families involved – as, it was alleged, the Church reverted to its medieval behaviour and exacted 'death-bed gifts' (Jones, 1969:109). The result of these fears was the passing of the Mortmain Act of 1736, under which any transfers of land to charitable purposes would be void at law unless the transferor survived the transfer by at least one year. Although this appears to be a relatively short time to us today, it has been estimated that the average time lapse between writing a will and death was four months in the Stuart period (Jordan, 1959:16). In fact, Lady Hastings made her will and the deed of settlement transferring lands to the charitable trust in 1738 in the knowledge that she was suffering from breast cancer. The deed of settlement was sealed on 14 December 1738 and Lady Hastings underwent an operation to remove the cancer. The cancer returned and Lady Hastings died on 21 December 1739 – exactly one year and one week after sealing the deed.

Under the deed of settlement, she left a substantial estate of around 1,340 acres of prime agricultural land[10] including the manors of Collingham, Wheldale and Shadwell, and her estates in Burton Salmon, Thorp Arch and Wike, plus land in Ledsham (all situated in Yorkshire between Leeds and York) principally for the upkeep of the charity schools and orphanage which she had founded. These schools were located in the villages of Collingham, Thorp Arch, Ledsham, Wike and Shadwell. Ledsham contained two schools – one for boys, and one for girls (which also functioned as a girls' orphanage). The deed of settlement also provided for the support of other charity schools both within and beyond Yorkshire – at Pontefract and Aberford in Yorkshire, at Howe in Norfolk, at Melbourne in Dorset, for the Chelsea school for children of soldiers, and for schools in the Isle of Man.

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[9] As one might expect, the governance structure today is not exactly the same as it was in 1739 owing to the institution of the Charity Commissioners as overseers of charitable trusts.

[10] Calculated from the acreages given in the Trust rental roll, land purchased and disposed of.

In addition to the educational provisions the endowments provided specific amounts for the sacraments at the churches within Lady Hastings' manors and estates, and for support of the Ledsham almshouses (see Appendix 1). Any surplus of revenue over expenditure, or unused endowment arising from the redundancy of any of the objects of the charity, or other possible incomes for example from the exploitation of coal deposits, were authorised to be used to provide financial support (in the form of donations) for poor clergy; for apprenticing young people; for the relief of prisoners for debt; for the relief of the deserving poor; and for the provision of interest-free loans to young people in order to set up in business. The manors and lands so bequeathed yielded a steady rental income which was to be applied in accordance with a detailed schedule (set out in Appendix 1) (Deed of Settlement and Schedule relating to the Perpetual Charities appended to the will of Lady Hastings, 1738).

5. Governance of the Lady Elizabeth Hastings Trust

5.1. Structure of the Trust

The structure which Lady Hastings set up addressed the inevitable agency problems through what are now regarded as traditional means, that is, through monitoring and through use of a form of contract (Cyert and March, 1963; Fama, 1980; Jenson and Meckling, 1976). A more general societal control lay in the power of religious belief which would help ensure compliance at a time when there was no effective control in law. The structure of the Hastings Trust, however, also presents a paradox in agency theory terms. Whereas under agency theory the problem of abuse by agents arises as a result of the separation of ownership from control, in the Hastings Trust such separation was deliberately employed as a means of preventing abuse by the proxy owners. Legal ownership of the estate, which was vested in gentry trustees, was separated from control, which was placed in the hands of the three vicars of Ledsham, Collingham and Thorp Arch, and their agent, the bailiff. In this way, the potential for abuse by the (gentry) trustees was removed, and the fate of many other charities (such as those of Normanton Grammar School, and the Mary Lowther Trust described earlier) was avoided.

The governance structure of the Trust is set out in Figure 1, which has been composed from the archival evidence.

The organisational structure of the Trust consisted of multiple principal-agent relationships. In addition, the control structures comprised a two-tier audit. The lands transferred to the Hastings Trust were vested in a board of five trustees drawn from the local gentry. The original board members had been known personally to Lady Hastings,[11] but on the death of a particular trustee, the trusteeship passed to his heir. The deed of settlement did not give the trustees an active role in the management of the trust or any control over the revenues generated by the estate, although they may have exercised a general 'watchful eye' on the running of the charity. Significantly, the trustees' legal position as holders of the titles to the Trust's lands meant that the active agents – the managing vicars – were not legally empowered to dispose of the Trust's assets. In one sense, the trustees, along with the vicars and the Chancellor were all agents to Lady Hastings in that they held their positions vis-á-vis the Trust by virtue of her deed of settlement. However, following her death it might be supposed that the trustees became principals (as the legal 'owners' of the assets) but as they had neither managerial powers within the Trust nor powers over the appointment of agents (either managing vicars or bailiff), their supervisory powers were very weak. Good management of the Trust, thus, depended on the vicars and on the efficacy of the control mechanisms put in place by the original principal, Lady Hastings.

The management of the Trust, and the responsibility for carrying out the instructions set out in the Deed of Trust, lay in the hands of the three vicars. They had control over the income generated by Trust lands and property, and had the power to hire and fire the bailiff. The bailiff reported to the vicars, who conducted an annual audit of his accounts. In turn, the vicars 'reported' to the Chancellor of the Diocese in the sense that that senior member of the Church conducted a periodic audit of the Trust accounts, and monitored compliance of the managing vicars with the instructions set out in the Deed of Trust.

5.2. The bailiff: duties and controls

Day-to-day running of the Trust was carried out by the bailiff. The bailiff was responsible for both collecting rents (due twice yearly) from the tenants of the Trust estate and for making the regular charitable disbursements (such as paying the salaries of the schoolmasters). The bailiff's second function was that of managing the Trust estate. Here, he had to maintain the estate property in good repair, to nurture the woodlands which formed an important source of potential income, and supervise maintenance work to be undertaken by the tenants or tradesmen. The bailiff was to be paid at the rate of 6d in the £ on rental revenue and 1/– in the £ on

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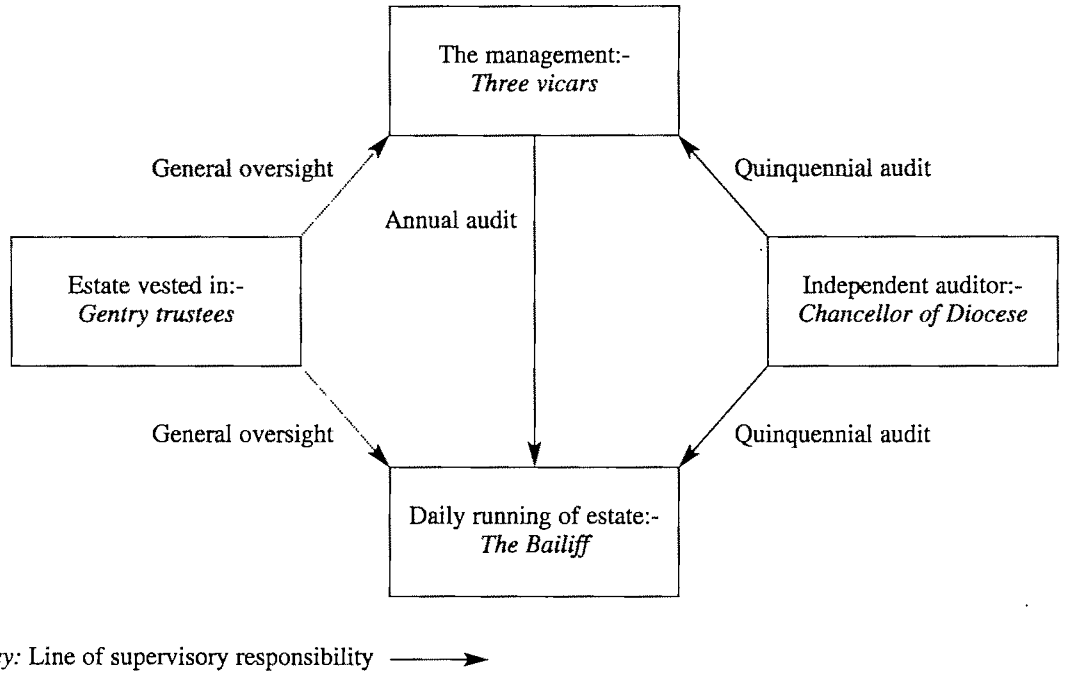
[11] They were – The Hon. John Downey, heir of Lord Viscount Down, Sir John Bland, Baronet, of Kippax Park, Sir William Lowther, Baronet of Swillington Hall, George Crowle, esquire of Ferry Fryston Hall, Richard Wilson the younger, esquire, son of Richard Wilson, esquire, Recorder of Leeds.

Figure 1
Governance structure of the Hastings Trust 1739–1853



timber sales, that is, 2.5% and 5% of revenues respectively. He was also responsible for drawing up the accounts.

The vicars were instructed to appoint a bailiff:

> '...who shall give bond with sufficient surety [of £300] for his good behaviour and faithful performance as bailiff for collecting and managing the trust estate and for the due accounting for the rents & profits thereof...(Extract from the 'Schedule for appointing perpetual charities referred to in the Deed of Settlement', 1738. Ledsham parish records, [PR LED 21], Borthwick Institute, York.)

The actions of the bailiff were to be controlled not only by a bond, but also by the judicious choice of a bailiff in whom one could trust, and finally by monitoring:

> 'And that in the choice of a bailiff... his integrity & a competent knowledge of accounts & lands with humility industry & diligence be chiefly regarded also that the bailiff's accounts be narrowly inspected into (the greatest abuses in charity often proceeding from that quarter) & if any bribe or gratuity as it may be called can be proved against such bailiff that he be immediately dismissed. Also that such bailiff shall live at convenient distance from the trust estate & that no person who shall practice as an attorney or solicitor shall be employed as bailiff of the trust estate.' (Extract from the 'Schedule for appointing perpetual charities referred to in the Deed of Settlement', 1738)

Thus the bailiff, as was common at the time, acted not only as estate manager and surveyor, but also as treasurer and book-keeper. It was for this reason that Lady Hastings directed the vicars to appoint a person of integrity (interestingly, she specifically excluded lawyers) as well as ability, noting that failure to appoint an honest person often resulted in abuse of a charity. In addition to the bond, a further safeguard of good conduct of the bailiff was the stipulation that the taking of bribes or gratuities should result in dismissal. The bailiff was required to maintain an audit trail by giving receipts for monies collected, obtaining receipts for payments made, entering all transactions into the account book and balancing off at specified annual intervals (mid-summer). This audit trail was to be examined annually during the first week in August by the three vicars, meeting at Aberford – a geographic mid-point between their three parishes. The cash balance was held by the bailiff, and as a further safeguard against misuse of trust funds, any surplus in excess of £20 over anticipated expenditure was to be deposited with Hoares, the London bankers.

The first bailiff, Miles Lowly, a yeoman farmer from the village of Aberford, was appointed on 20 April 1739, and duly provided a 'bond with two or more sufficient sureties in the penalty of £300'. This, of course, was a considerable sum in 1739, being almost equal to the entire annual rental income of the trust estate at that time.[12] The bailiff's accounts were maintained on a bi-lateral charge and discharge basis. The accounts were balanced at the year-end and the resultant balance represented either money held by the bailiff ('debtor to the Trust') or money owing to the bailiff ('creditor to the Trust'). Lady Hastings, as a landowner who took an active part in the management of the estate, would have been acquainted with the manorial system of accountability and record keeping, and so it is not surprising that she instituted a similar procedure upon the running of the Trust, and stipulated the need for frequent, periodic audit.

5.3. The managing vicars: duties and controls

The managing vicars took the major decisions regarding the administration of the trust. The vicars were responsible for ensuring the proper running of the schools and orphanage, the good conduct of the schoolmasters and mistress of the orphanage, and for overseeing the bailiff. They were to ensure that the revenues generated by the estate were being properly applied by the bailiff in making the annual charitable payments, maintaining the schools and estate property. The vicars also issued instructions to the bailiff on matters such as authorising expenditure on major maintenance or rebuilding work, and the payment of benefactions to the poor, the sick and the deserving. Such instructions were to be entered into a 'Book of Negotiations', along with the minutes of the vicars' meetings, and signed by at least two of the three vicars *'in order that it may appear by what authority each act relating to this charity was done'* (Deed of Settlement – italics added). In addition to identifying the vicars responsible for issuing each order, this also conferred the benefit of preventing a single vicar from making unauthorised expenditure. At least two vicars were to conduct the annual inspection of the bailiff's accounts, for which each received the sum of £1 per annum, payable every five years.

Lady Hastings attempted to ensure that the vicars not only discharged their monitoring function over the bailiff diligently but also did not abuse their own position, by subjecting the vicars themselves to inspection. She imposed a requirement for periodic audit by the Chancellor of the Diocese of York. The Chancellor acted as Vicar General to the Bishop, presided over ecclesiastical courts, and was, in effect, the diocese's senior legal adviser. As the Chancellor was external to the Trust and was appointed neither by the managing vicars nor the ultimate stakeholders (the Trust's beneficiaries), this audit may be deemed independent audit.

5.4. The Chancellor: duties and control

The Deed of Settlement dictated that the Chancellor of the Diocese (and each succeeding Chancellor) was to receive a copy of Lady Hastings' instructions for the running of the Trust as contained in the Schedule to the Deed of Settlement. At five-yearly intervals the Chancellor was also to receive a copy of the accounts and the 'Book of Negotiations'. The Chancellor was charged with carrying out a careful audit of the accounts, verifying their accuracy and checking the audit trails, and examining the actions of the vicars for compliance with Lady Hastings' instructions. The Chancellor was charged to 'mark well all errors & mistakes voluntary & involuntary, & all deviations from the orders & appointments herein made & established & admonish the aforesaid three vicars of the same for the greater exactness of their conduct afterwards & in all times to come'. This admonishment (or approval in the absence of 'deviations') was to take place at a meeting of the vicars, bailiff and Chancellor one week after delivery of the accounts and associated documentation to the Chancellor. Significantly, the Chancellor was also required to append an audit statement which was declarative of the diligence and integrity of the vicars or otherwise, and admonishing where necessary.

In present-day terms the Chancellor had to set out an unqualified or qualified audit statement. For his role as auditor the Chancellor was paid £10 for each quinquennial inspection, a sum which exceeded the bailiff's annual salary, and was, perhaps, pitched at a level which would help ensure a thorough audit (see Chandler and Edwards, 1996 for a discussion of audit fees and adequacy of audit during the 19th century).

In terms of principal-agent relationships, the Trust was multi-layered. The bailiff clearly acted as agent to the managing vicars – they appointed him, and it was to them that he reported. The managing vicars were, thus, taking on the role of principal with regard to the bailiff, but were themselves subject to scrutiny by the Chancellor. The Chancellor's audit of the accounts and verification (or otherwise) of the compliance of the vicars with the directions laid down by Lady Hastings might possibly be construed as the Chancellor occupying the role of principal and the vicars as agents to him. However, although the Chancellor could, and did, admonish the vicars when he felt it necessary to influence their conduct in the running of the charity, he had no real power over them excepting the influence derived from his position as a senior official in the Church which employed them – they were all men of God.

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[12] It is unlikely, therefore, that third parties would stand as guarantors for such a sum unless they were sure of the new bailiff's integrity. Miles Lowly did, indeed, diligently discharge his duties for 24 years, until his retirement. In fact, for many years this bailiff stood as creditor to the Trust with amounts owing to him varying from under £2 to over £20. He was unfortunate to have taken up office during a time of severe agricultural depression in which there was a high level of rent arrears (the usual cause of deficit balances in the accounts up to 1786) by the tenant farmers. During the 19th century, rent arrears were a contributory, but not a major cause of deficit balances. During this period, deficits, which varied from just over £20 to just under £250, were usually accompanied by a high level of expenditure on estate maintenance (including enclosure) and improvement. See Postles (1981) and Noke (1991) for discussion of whether the deficit balance owed to a bailiff represented the use of the bailiff's own resources in funding the estate. In the case of the Hastings Trust, the audit statements made at the quinqennial audit frequently stated that the Trust was indebted to the bailiff, and referred to the liquidation of the debt. It would thus appear likely that a deficit balance represented actual cash owed.

The first Chancellor to be appointed would presumably have agreed to the role allotted to him by the Deed of Trust drawn up by Lady Hastings. In this case, the Chancellor, although independent of the vicars and bailiff, could arguably be described as acting as agent to Lady Hastings. However, by the time of the first quinquennial audit Lady Hastings was already dead. The beneficiaries of the Trust were passive recipients of its charity and took no part in its administration. Although the gentry trustees might be regarded technically as the principals, as we have seen they also took no active role in the administration of the Trust. There is no evidence of any Chancellor reporting to them, and they were – just as was the Chancellor – in this context, part of the apparatus which ensured compliance with Lady Hastings' wishes. The question of who is the principal and what is the status of the Chancellor within an agency framework is a complex one.

5.5. The clergy and society

The choice of the Chancellor of the diocese to act as auditor of the management of the trust was an exceptional, and crucial, component in the monitoring of the Trust. However, the appointment of men of the cloth as managers of charities, and as 'visitors' to oversee charities, was not exceptional.[13]

As we have argued earlier, common religious beliefs shared by all the participants in the management and monitoring of the Trust (as well as by the benefactress) would have provided an important underpinning to the continued compliance with the benefactress' stipulations. As for the desire to conform with the wishes of a deceased benefactress, it seems reasonable to conjecture that men of the cloth were the most likely citizens to believe in the after-life and a day of reckoning – to live in the fear of God and conduct themselves accordingly. Clergymen also offered more practical skills. The qualities required would be knowledge of accounting and estate management, and a desire to ensure the proper use of the endowed resources. Chatfield comments that 'As early as the 6th century deacons were appointed to administer Church properties and report on their revenues' (Chatfield, 1977:20). For centuries the Established Church had been a considerable landowner,[14] from the medieval monastic establishments to the later organisational units of the bishoprics, and it may reasonably be expected that estate accounting would have played a prominent role in the recording and monitoring of revenues and expenditures within these large and wealthy units. In addition, clerics were frequently drawn from the younger sons of the landed classes, among which it may also be expected that there was some familiarity with estate accounting. Moreover, clerics were among the few who received university education at either Cambridge or Oxford, where accounting had been added to the curriculum in the 13th century (Edwards, 1989:37).

As Jones (1985) has pointed out in his comprehensive examination of accounting practices in English local government, clergymen were also involved in local administrative affairs from medieval times. The parish was 'by far the most numerous [local administrative unit] and it was the only unit of local government which covered the whole country' (1985:199). McClatchley (1960) also emphasises the wider role of the clergyman within his parish. At the centre of the parish was the church with responsibility for parochial affairs devolved onto the officers of the church under the eye of the parish priest. Indeed, the involvement of the local clergy with the parish extended far beyond matters spiritual. The village priest could be engaged in matters as diverse as teaching, operating soup kitchens, savings banks, almshouses, workhouses, Sunday schools, nursing associations and allotment schemes, assisting in emigration, acting as scribe, landlord and housing provider for the poor,[15] village policeman, justice of the peace and Commissioner of Inclosure (1960:97).[16]

Thus, appointment of vicars as managers of charitable trusts was commonplace in the period under study but the choice of Chancellor of the Diocese to act as independent watchdog seems to have been very unusual (although the lack of similar historical research in this area makes it impossible to be adamant). Lady Hastings was herself a deeply religious person, and a substantial benefactress to the Church. One example of this was her provision in 1720 of £1,000 for the building of Trinity Church in Leeds. She was also well acquainted with the individuals occupying the top hierarchy of the Established Church, counting the Archbishop of York and Bishop of Durham amongst her close friends (Medhurst, 1914). It seems reasonable to suppose, therefore, that she was sufficiently familiar with their capabilities, mores and religious convictions to believe that, together with the clergy's own perception of its role in society, there would have been strong inducements to the Chancellor of the Diocese to discharge conscientiously the audit function laid upon him. It may also have been the case that Lady Hastings recognised (as were the Charity Commissioners to do so later, in the 19th century) that, where a charitable trust was not being run in accordance with the benefactors' directions, it was beyond the reach of the intended beneficiaries – the poor and uneducated – to attain legal redress.

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[13] The rise of the professional accountant and auditor was still many years away (see Matthews et al. 1998 and Maltby, 1999 for accounts of the rise of the professional accountant) – in fact, Ernest Cooper claimed that the earliest mention of professional accountants in the London Directory was not until 1776 (1886:33). It is, therefore, unsurprising that the role of accountant frequently fell to other 'professions' such as merchants, lawyers and the clergy (Littleton, 1933:265).

[14] It is estimated that by the late middle ages, ecclesiastical institutions controlled between 20% to 25% of agricultural land in England, and that contemporary estimates made in the early 16th century put the figure at one-third (Swanson, 1989:196).

[15] The practical obligations of the clergy to care for the less fortunate in society were extolled by contemporaries such as Gladstone (1840) and Arnold (1833).

[16] Norman (1976), too, illustrates the heavy involvement of the parish priest in social activities during the early decades of the 19th century – primarily the alleviation of the miseries of poverty and sickness, the provision of education and the care of the destitute (1976:126).

The significance of the governance structure of the Hastings Trust for accounting history lies primarily in the establishment, as early as 1739, of what, in present-day terms may be called an independent audit.

6. Effectiveness of the control structure

Accounting information and reporting systems are of value in detecting three main aspects of poor financial management: deliberate acts of fraud, non-compliance with instructions, and financial ineptitude. At the inception of the Hastings Trust, the annual income – derived entirely from property rental (farms, cottages and water-driven corn mill) – amounted to £325 14s 11d, which was sufficient to meet the annual charitable payments of £306 10s as specified in the Schedule (see Appendix 1), plus the five-yearly payments (an annualised amount of £6 4s) with a small margin for expenses. Additional revenue could be raised through the sale of timber, but the woodlands were a resource which had to be managed and renewed in order to avoid depletion. Furthermore, the use of revenues from the woodlands had also been prescribed by Lady Hastings for specific purposes.[17] It was therefore important to the viability of the trust that the estate resources should be managed efficiently, and in the proper manner.

6.1. Deliberate acts of fraud

The historical record shows that the auditing system put in place by Lady Hastings was effective in detecting mis-use of funds by the bailiffs on a number of occasions. The fact that the expected rental revenues were known in advance, that all arrears of rents had to be detailed, and that all expenditures had to be supported by receipts (which were produced for the annual audit), made misappropriation of funds difficult. Unauthorised expenditures, even if supported by receipts, were subject to query by the vicars, and attempts to divert receipted materials for the bailiff's own use was made more difficult by the detailed nature of the account book entries which enabled easier verification. The following examples of these detailed entries were drawn from the account book:

> 'To Mr Oxley's bill for phsyck for Ledsham school £5 0 0', 'To Robert Middleton for chaises to York with Mr Sellon and Mr Harrington £0 11 4', 'To David Ramsden for bricks and tiles for Boggett's house £11 11 0', 'To Mr Park [attorney] for his opinion respecting the road down Burton Salmon common claimed by Sir John Ramsden to Middleham's farm £2 7 0', 'Paid Rev Carr of Thorner for damages done him by getting materials in one of his closes for stoning the mill lane at Collingham £6 16 6', and 'Forgiven, John Powell's arrears by Rev Sellon's orders £2 5 6'.

Although it would be impossible to say that there was no undetected misuse by the bailiff, the detailed reporting and the requirement for receipts made unauthorised expenditure difficult to execute without the compliance of third parties (who would in any case be named in the accounts).

Examination by the vicars of the bailiff's accounts and supporting receipts and vouchers took place annually from 1739 until 1772, and all was found satisfactory. The first quinquennial audit by the Chancellor of the Diocese took place in 1744 and also found all to be satisfactory. Interestingly, the audit statement ran to over 350 words, including a declaration that the accounts were 'Just and True'.[18]

Irregularities on the part of the bailiff were detected on two occasions. The first 'detection' occurred at the quinquennial audit of 1772 and related to payments made on the sale of timber. Although the vicars had passed his accounts, the Chancellor noted a deviation from the instructions of Lady Hastings in that the bailiff, John Simpson, had paid out £25 from Trust funds to other men to carry out the marking of trees to be felled (a task which he should have performed himself) whilst paying himself the full commission of £49 due on the timber sales. The Chancellor disallowed the £25 payment, ordered reimbursement by the bailiff, and further noted the bailiff's failure to carry out an order of the vicars (as registered in the Book of Negotiations) to conduct a 'stock take' and valuation of the timber growing on the estate. The Chancellor went on to record the response of the bailiff, which was to ask for an increase in the commission on rents collected from 6d to 9d in the £. The Chancellor considered this to be out of keeping with the Deed of Settlement and Lady Hastings' instructions.[19] The bailiff subsequently resigned.

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[17] A first sale of timber to the value of £500 was to be made in order to make additional specified one-off charitable payments to individuals, churches, and almshouses. The second sale of timber to the value of £500 was to be invested in government stock, and the interest from this used to finance repairs and maintenance to the estate.

[18] The equation of justice with fairness (Chastney, 1975:7) renders this akin to the 'True and Fair' declaration (which became part of UK law only as late as 1948), the origins of which '..can be traced back to more than a century earlier' (1975:4), via similar phrases. In the case of the Lady Hastings Trust such a term was employed more than *two* centuries earlier.

The control mechanism was more severely tested in the 1790s when the position of bailiff was held by Edward Shirtcliff, who had taken up office in 1781. By 1794 the accounts had become difficult to read with numerous crossings out and alterations. Consequently, the vicars refused to pass the accounts for 1795. It is possible that this bailiff took advantage of the fact that two of the three vicars were elderly and infirm, and unable to attend meetings, a third died and was replaced in 1791. Consequently the interval between the 'annual' meetings during this phase stretched to periods of about four years. At the meeting of August 1795, the dismissal of Shirtcliff and the appointment of the Rev Richard Paver as bailiff, was announced. A meeting one month later decided that the accounts of Shirtcliff should be re-examined from the commencement of his bailiffship, and a proper statement be drawn up for the vicars' inspection. The quinquennial audit was held in October 1795, and Shirtcliff was given three months to examine the accounts (now in the possession of the new bailiff) and offer an explanation for the discrepancies detected in the accounts. This he failed to do. The final audit statement of Chancellor Markham, dated January 1796, identifies, amongst other discrepancies, the bailiff's over-payment of salary to himself, failure to carry forward in the accounts rent arrears amounting to a loss of £87/16/3, an expense of £24/4/6 charged twice, failure to obtain satisfactory receipts and vouchers to support the account entries, failure to account for the cash balance handed over to Shirtcliff from the previous bailiff, general neglect of the estate buildings and woodlands to the point of decay of many of the farm buildings, and failure to carry out instructions regarding maintenance of the woodlands.

For the first time in the Hastings Trust records, the quinquennial audit statement was what we might now term 'qualified'. The Chancellor concluded with the statement 'I conceive that the Rev John Tattersall, and also the Rev. Robert Hemington, and Rev George Etherington, *in so far as they have acted, have as far as they reasonably could, complied with the directions of the deed of trust*, according to the pious intention of Lady Elizabeth Hastings' (italics added). Thus, the auditing procedures put in place in 1739 had successfully detected the misappropriation of funds and failure to execute necessary duties on the part of the bailiff though, of course, they had failed to prevent abuse by the bailiff. The Chancellor was thus able to take corrective action and oblige Shirtcliff to make full restitution of the Trust's funds.

The behaviour of Shirtcliff taught the vicars the necessity of employing a trustworthy bailiff who could keep reasonable accounts. Previously the bailiffs been drawn from yeoman farmers. Now the vicars turned to the clergy (a further illustration of the importance of 'trust'). Edward Shirtcliff's successor as bailiff, the Rev. Richard Paver, was the schoolmaster at one of the Hastings Trust charity schools, Ledsham Boys' School. As part of his duties he was required, on the instructions of Lady Hastings' deed, to teach the boys to 'cast accounts' in case they should one day be farmers themselves. Paver therefore had some accounting knowledge, plus the integrity of the cloth. From hereon the account books regained their former immaculate presentation, and the Rev. Richard Paver combined his job as schoolmaster with that of Trust bailiff, a tradition which was to continue until 1808.

6.2. Non-compliance with instructions

No further instances of fraud were found in the period studied. The extent to which this was a function of the honesty of the succeeding bailiffs, or the preventative effect of the audits is impossible to determine. There were, however, several instances of the vicars' failure to comply with the terms of the deed, and these generally related to benefactions made by the vicars. Criticism of such benefactions was made on four occasions by the Chancellor, in the audit statements of 1800, 1816, 1821 and 1853. By 1800 the Rev Richard Paver (the bailiff) had succeeded in restoring the financial soundness of the Hastings Trust by improving the physical condition of the estate and eliminating rent arrears amassed by his predecessor, Shirtcliff. The vicars took this opportunity to make additional benefactions such as donations for the relief of economic distress which were in excess of that allowed by the deed. In fact, their total benefactions were almost three-fold the amount authorised by the deed, and of this three-quarters went to fellow clergy and their families. On this occasion they were mildly rebuked by Chancellor Markham, and the audit statement was again qualified.

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[19] The audit statement itself is long and detailed, running to more than 800 words.

Excess benefactions were also criticised in 1816 and 1821. By this time, the vicars had spent considerable sums in bringing about the enclosure of Shadwell, and in rebuilding works on the trust estate. They had borrowed £500 from a York bank (Raper, Swann & Co) and were indebted by a significant sum to the bailiff. At one point, in 1818, the amount owing to the bailiff was an amazing £247. Despite this indebtedness, the vicars had continued to make extra benefactions. The benefactions themselves were fairly modest, varying from £12 to £25 and were for the relief of those in need, such as the £20 to William Morrit of Ledsham 'having sustained great loss after two haystacks caught fire'; the £20 to Walter Todd of Ledsham 'in consequence of an operation his wife was compelled to undergo, having for some time been severely afflicted by a cancer in the breast'; and the £10 to Rev. Cornwall curate of Wootton under Edge 'being nearly blind and having a large family'. They were all good causes, but in total exceeded the amount authorised under the deed of settlement.

The fourth mention of benefactions in the quinquennial audit occurred in 1853, and related not to the amount of benefactions, but to some of the recipients. The vicars had, over a three-year period, made donations to Ripon Diocesan Church Building Society (£50), West Riding Charitable Society for the widows and orphans of clergy (£10), the Society for Propagating the Gospel (£50), the Society for Promoting Christian Knowledge (£50), Curates' Aid Society (£50), York & Ripon Diocesan Training School (£30), and to the Bishop of Toronto for the Upper Canada Church University (£10). None of these donations was authorised under the terms of the deed. In contrast, the donations which the vicars were authorised to make, such as for apprenticing young men and women, and payments for the relief of the deserving poor, were of relatively small amounts. Moreover, of these latter, significantly more financial assistance went to the clergy than to non-clerical households: for example, £5 towards the support of 'the distressed orphan family of John Walker deceased, late of Ferrybridge; both parents having fallen victim to the cholera leaving ten children without any provision', contrasted with a donation of £30 made six months later to the Rev. James Dixon 'being in great distress, and perpetual curate of an Incumbency of small value in the Parish of Leeds'. Such examples were numerous during the years up to 1853. Nevertheless, although the vicars were reprimanded for exceeding their powers, such 'abuses' of the Trust's resources were relatively minor, were not for personal gains but, rather, represented their personal prejudices and priorities. Critically, though, the Chancellor stuck to the strictures laid down by Lady Hastings over one hundred and twenty years earlier, and reprimanded the vicars for their misdemeanours.

The issue of failing to follow the procedures laid down by Lady Hastings was raised in three of the quinquennial audits, 1800, 1807, and 1821. The audit of 1800 reprimanded the vicars for the excessive amount of cash balance accumulated, with almost £856 left in the hands of the bailiff (the deed stipulated that any excess be deposited at a bank). The audit of 1807 again questioned procedure, this time in relation to loans made by the Trust. Whereas under the deed surplus funds were to be deposited with Hoare's bank, or invested in government stock (and the interest used for charitable purposes), in practice, the Trust had been making loans totalling £500 at 5% interest to individuals, upon bond, with the bailiff acting as intermediary. The most usual offence, however, (commented upon at the audits of 1800, 1807, and most severely in 1821), was that of failing to authorise orders to the bailiff (normally relating to benefactions) by at least two of the vicars. Significantly, the 1821 audit statement was the first which did not endorse the conduct of the vicars in the discharge of their duties, even though the accounts were declared 'just and true'. The seriousness of this was realised by the vicars who thereafter amended their conduct in regard to the authorising of expenditure.

6.3. Financial ineptitude

The vicars might well have been considered guilty of financial ineptitude on a number of occasions. For example between 1824 and 1827 they invested £200 in the Leeds to Collingham Turnpike, and expended further sums in excess of £30 in maintenance and other expenses concerned with the turnpike. In 1832 they received the first return (of £11) on this investment, and this amount was received annually for 18 years when it fell to around £5 for the following five years. Thereafter returns ceased until the Turnpike was dissolved and a final payout of £11 was received in 1879. Thus after 55 years the total returns of £234 had simply paid back the initial investment. The same vicars who made this investment decision received the most severe admonishment ever issued, in the 1827 audit statement. This was the second audit conducted by Chancellor Vernon. He had not endorsed the conduct of the vicars in his previous audit of 1821. This time they were left in no doubt as to his views regarding the discharge of their responsibilities. Chancellor Vernon severely reprimanded the vicars for undertaking large expenditure on property maintenance and rebuilding, remarking that '...an expense has been adopted ...which would not have been warranted by any principle of managing the trust estates to the best advantage'. Indeed, between 1821 and 1827, £632 5s 0d had been spent on property maintenance and a further £636 on building and rebuilding, with just three tenants accounting for £326 of this. An additional £311 was spent on rebuilding in the following year. In stark contrast, over the same period the rent roll rose by just £32.

Following this audit, the management of the Trust took on a tighter aspect. Tenants who had failed to maintain Trust property adequately were evicted (for example the blacksmith at Collingham, who had occupied two cottages which had to be demolished and rebuilt), and the rental revenue was increased by around £240 per annum over the following two years. Chancellor Vernon reported his satisfaction at the running of the Trust at the following quinquennial audit, and consistently thereafter until he retired in 1877. What is significant about the audit of 1827 is the nature of the compliance check conducted by the Chancellor. He did not simply verify the accuracy of the book-keeping, and compliance with the instructions contained within the Trust deed, but reported upon the financial and economic management of the Trust's estate of land and property. This was an uncommon, and notable, feature of the auditing practice of the 1820s.

7. Conclusions

The study presented here has shown the existence and efficacy of a system of accountability through audit within a not-for-profit organisation, dating from an unusually early period, the first half of the 18th century. The control mechanism in this case provides a vivid contrast to the practices prevalent in the commercial sector over the same period (Cooper, 1886; Lee, 1986; Robb, 1992; Maltby, 1999; Matthews et al., 1998). Whereas in the commercial sector, internal audits were by no means commonplace, external audits rare, and effective independent audits virtually unheard of (and were uncommon even well into the 19th century), they were the normal state of affairs in the Lady Hastings charitable trust from the first half of the 18th century.

The accountability and control mechanisms put in place by Lady Hastings included tried and tested methods: the use of receipts and vouchers to produce an audit trail, and the use of the auditor to verify the accounts of the bailiff. She also devised a hierarchical control structure which separated ownership (of the land) from control (of the resources), beneficially in this case. Furthermore, and most important, she instituted an independent monitoring function complete with detailed instructions.

Note that each succeeding Chancellor of the Diocese was effectively appointed as auditor by Lady Hastings, and not by those being monitored, unlike modern corporate external audits. In this regard, it can be claimed that the quinquennial audit of the Hastings Trust was considerably more independent than the auditing practices in contemporary commercial enterprises. Indeed, a case could be made that they were more independent than present-day corporate arrangements.

Lady Elizabeth Hastings made these arrangements in the knowledge that she was soon to die, and that if the Trust was to survive, the monitoring and control arrangements had to be robust. Crucial to this robustness was the role of the Chancellor, as an independent auditor – independent of the managers and of the trustees. To this end, the findings of this study are consistent with those of Watts and Zimmerman (1983), and Mills (1990) – that independent audits did not arise in modern times as a product of government mandate, but instead arose as a consequence of their value as a device for monitoring and control, serving the needs of the organisation, in this case, a not-for-profit one.

The objective of the independent audit in the Lady Hastings Trust was to ensure that the vicars discharged their duties of proper supervision of the bailiff and his accounts, and of applying the revenues of the Trust in accordance with Lady Hastings' instructions. It is extremely unlikely that over a 114-year period, with eight different bailiffs and 21 different vicars there would have been no instances of misdemeanour. As we have seen, there were. However, after a thorough study of the accounts, we have a firm impression that the Chancellors' independent audits were successful in picking up misappropriation and misapplication of funds where this occurred. Whether or not the control system put in place by Lady Hastings was unique is not yet known, and is the subject of ongoing research. However, examination (by the authors) of other contemporary charitable trusts, have not revealed any system comparable in the rigour of the monitoring process, or in the separation of duties (between trustee and managing vicars). This may be due to the unusually large size of the charity. It is unlikely, for example, that the cooperation of the Chancellor of the Diocese would have been obtained for a similar role in the myriad of small charities which proliferated in the 18th and 19th centuries. Nor could small charities have afforded the fees which accompanied the Chancellor's employment.

Finally, we believe the study further demonstrates the valuable contribution which can be made to the knowledge of accounting history through investigation of not-for-profit organisations, particularly with regard to the role of societal influence and control prior to the emergence of the professional accountant and auditor. As we have shown, the Hastings Trust, succeeded in large measure in controlling the actions of the agents and in maintaining compliance with the principal's wishes, long after the death of the principal. It did this through the efficacy of the auditing and control measures, and through the use of the pressure of the Established Church – in the guise of auditor, managers and, occasionally, even bailiffs – as means of societal control at a time when redress at law was not a practical option.

Appendix 1

Schedule of the perpetual payments made under the Deed of Settlement

Annual payments to

Churches of Ledsham, Collingham, Thorp Arch, Thorner, Mirfield, Aberford and Howe, £2 each for the sacrements	£14	
Almshouses at Ledsham	£30	£44
Charity school at Pontefract	£5 5s	
Charity school at Aberford	£5 5s	
Charity school at Melbourne	£10	
Charity school at Howe	£5	
Charity school at Chelsea	£10 10s	
Charity schools in Isle of Man	£20	
Charity school at Wyke	£5	£61
Ledsham girls-school:-		
Maintenance of mistress and maid and 20 girls	£82	
Clothing the girls	£18	
Articles for household use	£5	
Mistress' salary	£10	
Medicine & books for Ledsham charity school for girls	£5	
Maid-servant's salary	£2 10s – £4	
Pension for superannuated mistress of the Ledsham girls school	£10	£132 10s
To Master of Ledsham charity school for boys, for:-		
Salary	£17	
Training a youth as a charity-schoolmaster	£1	
Maintenance of youth being trained	£9	
Reading prayers at the almshouses	£2	
Teaching four elder girls in Ledsham girls school (the orphanage) to write, and examining the children on Sundays	£2	
Keeping the accounts for the mistress of Ledsham girls school, and a school register	£2	
Master of charity school at Thorp Arch – salary	£15	
Master of charity school at Collingham – salary	£12	£60
Books for Ledsham charity-school for boys	£3	
Books for Thorp Arch charity-school	£2	
Books for Collingham, Shadwell and Wyke charity-schools	£3	
Books for charity school at Howe	£1	£9
		£306 10s

Five-yearly payments to

Chancellor of Diocese of York, for auditing accounts every five years	£10	£10
Each of the three vicars, for passing the accounts each year	£5	£15
Each of the two co-adjutors of Ledsham charity school for girls, for assisting in monitoring the management of the school	£3	£6
		£31

Source: The last will and testament of Lady Elizabeth Hastings, including the Schedule relating to the Perpetual Charities, and the Deed of Settlement, 1738.

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Ledsham Parish Records, 1739; in the care of the Borthwick Institute, York.

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The costs and benefits of increased accounting regulation: a case study of Lloyd's of London

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Abstract—While a valuable literature exists on theoretical considerations in cost-benefit analysis (cba) of accounting regulation, and although the regulators themselves acknowledge the need for cost-benefit appraisal of their work, empirical analysis of the costs and benefits of changes in accounting regulation is almost non-existent. This paper attempts such an analysis for a step change in accounting and audit regulation – at Lloyd's between 1982 and 1985. It aims both to advance the cba methodology, and to inform debate about the evolution of the Lloyd's market. While the estimates do not show whether the changes produced an optimal level or form of Lloyd's regulation, they do suggest that, comparing changes, the extra benefits exceeded the extra costs – whether the chosen accounting unit is a private one – Lloyd's Names – or a social one.

The theoretical literature on the rationale for accounting regulation is now well-developed. The problems induced by market failures arising from information asymmetry have been rigorously explored and a potential role for accounting regulation identified (reviews can be found in Beaver, 1998; Bromwich, 1992; and Taylor and Turley, 1986). The theoretical literature has not, however, resolved the question whether regulation or autonomous market mechanisms offer the most effective response to the problems in the market for accounting information. On that issue appeal is generally made for an empirical resolution: '[A] priori there is no clear justification for corporate disclosure regulation. It is an empirical question of costs and benefits' (Watts and Zimmerman, 1986:178). And indeed, leading regulators are committed to limiting regulation to cases where, on a cost-benefit analysis, regulation offers net benefits: FASB's mission statement requires the Board to strive 'to determine that ... the costs [a proposed standard] imposes... are justified in relation to the overall benefits' (Scott and Upton (1991)); for the UK, the ASB's Sixth Fundamental Guideline is 'to issue accounting standards only when the expected benefits exceed the perceived costs' (ASB, 1991); and, in a recent Exposure Draft, the IASB (2003) proposed 'to require ...(an insurer) to disclose information without imposing costs that exceed the benefits...'.

It might be expected, therefore, that there would be a literature parallel to the theoretical one, scrutinising the costs and benefits of regulatory regimes and particular interventions. In fact the empirical literature is sparse and not in proportion to its role in the debate. There is a little market-based work on the major shift towards regulation which came with the accounting disclosure requirements of the 1934 US Securities Exchange Act (Benston, 1973) and the critique of Benston in Simon (1989). And there have been some useful market-based studies of the impact on share prices of specific regulatory changes (e.g. Peasnell et al. 1987) on UK CCA disclosures and Barth et al. (1996) on US fair value disclosures under SFAS 107). However, such studies were not, of course, ever designed to provide a full cost-benefit assessment of the respective regulation. One limitation is that their abnormal returns framework, focussing on deviations of individual share price movements from the rest of the market, may well not capture the effect of a programme of regulation which has a generalised effect on all share prices, for example by raising investor confidence in equities as a class of investment (relative to cash, gilts or property). Moreover, the gains or losses from a regula-

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tory change cannot be *equated with* abnormal returns. For example, a new accounting standard might bring benefits to the population of investors – because it revised expectations of earnings, and thereby led to improved resource allocation; but the revision might be *downwards*, so that abnormal returns for the particular investors in the affected companies were negative (as, for example, Ro, 1978 found for US companies which provided extra disclosure of their lease commitments). Then, even if the benefit for investors in a company arising from a change in regulation could be satisfactorily measured via the change in the value of their shares, this would still not represent the net social benefit of the change if all the costs of the change were not internalised. An example would be where the main costs of a regulatory change fell on the regulator who was publicly financed, through taxation: these costs would not be reflected in share price.[1]

Perhaps because of these difficulties with applying the usual techniques for quantifying the results of accounting change, the regulators are gloomy about the prospects for cost-benefit analysis: 'The Board [ASB] recognise that reliable cost/benefit calculations are seldom possible.' (ASB, 1991); while, in the US, a conference organised by FASB on cost-benefit analysis of accounting regulation produced the suggestion that 'cost-benefit measurement is a hopeless undertaking' (FASB, 1991: 30), and should be dropped from the Board's mission statement.

Not everyone shares this despairing approach, however. Carsberg and Page (1984), in their study of current cost accounting, advanced the subject with an analysis of the compliance costs associated with a major regulatory change in accounting. And systematic analysis of compliance costs is now a requirement of regulatory proposals being considered in any branch of the UK government (Deregulation Initiative, 1996): the responsible minister has also to take a view on whether the costs are outweighed by the benefits of the regulation.[2] Innovative attempts at cost-benefit analysis of mandatory information disclosure (though not in the conventional accounting arena) have been made for the US Federal Trade Commission (1982) and the US Occupational Safety and Health Administration (McGarity, 1991). And in other areas of the UK financial services industry, apart from accounting, the 1986 Financial Services Act has stimulated a growing body of cost-benefit analysis of diverse regulatory changes (e.g. SIB, 1995,1997), led now by the Cost-benefit Analysis Department of the Financial Services Authority (e.g. Alfon and Andrews, 1999).

Against this background of progress in cognate areas and of high aspirations from the accounting regulators – combined uncomfortably with only limited achievements in the accounting literature – we attempt here to augment the empirical literature with the first cost-benefit analysis of a major modern change in regulatory regime: the step change in accounting and audit regulation in one financial market, Lloyd's of London, in the early 1980s. We have chosen Lloyd's both because it is an unusually suitable subject for a pilot study exploring the possibility of cost-benefit analysis of accounting regulation generally, and because of its intrinsic interest. Two features of the Lloyd's market at this time make it especially amenable to such analysis and worth studying in its own right. First, an Act of Parliament (Lloyd's Act of 1982) marks a sharp change to defined accounting and auditing requirements from unregulated arrangements designed for 'a small society all of whose members were active in the Room'[3] (Davison, 1987:31), but remarkably informal for a market of its economic importance (at the time it was estimated that it accounted for no less than 14% of all UK financial institutions' invisible export earnings (Neill, 1987)). The regulatory arrangements for accounting and audit suddenly witnessed a change which, in industrial companies, had taken decades to emerge; and the speed of transformation from *laissez faire* to regulation at Lloyd's reduces the problems involved in observing its impact on costs and benefits. A second helpful feature of this case study is that it is unusual in offering high quality evidence on the question which normally bedevils this sort of analysis: what would happen in the absence of regulation? There were searching official investigations into malpractice in the market before regulation was introduced: these forced into the public domain hard information on costs incurred in the previous unregulated regime, which regulation aimed to eliminate, and which can be compared with the subsequent costs of enforcing regulation.

Section 1 outlines the context for regulation in the Lloyd's market before Section 2 specifies and quantifies the costs and benefits we attribute to increased regulation. Section 3 concludes.

1. The Lloyd's insurance market[4]

The regulation we consider in this paper is directed at the principal-agent relationship between the Lloyd's 'Names', the investors in the insurance market, and the 'Agents', who control 'Syndicates' providing insurance against particular risks. Historically each Name wrote insurance on his own behalf, judging what risks to accept, the rate to be charged, whether to reinsure a proportion of the risk, etc. But in a development parallel to the rise of the joint stock company, as the scale of business expanded, groups of Names would come together in syndicates to cover particular risks, each name having liability only for his share of the risk (though, of course, in contrast with the company case, **unlimited** liability for that share). Over time, syndicates grew larger (the largest numbered their Names in thousands); and, importantly, not all Names were active in the market. Access to Lloyd's was widened, overseas Names being admitted from 1969 and women Names from 1970. The number of Names more than tripled between 1975 and 1985. By the late 1980's 'external' Names dominated: fewer than 20% of the 30,000 Names were working Names who participated in the market.

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[1] See Meeks and Meeks (2002) for more discussion of these issues.

[2] Though Boden and Froud (1996) argue that government assessment of regulation has in practice generally been limited just to calculating compliance costs for regulatees, with no attempt to quantify benefits or to compare costs and benefits.

[3] Under a previous (1871) Lloyd's Act, 'All underwriting business transacted in Lloyd's shall be conducted in the underwriting rooms ["The Room"] and not elsewhere'.

[4] This section relies heavily on Gwilliam et al. (2000), Gwilliam et al. (1992) and Macve (1986).

The 1982 Lloyd's Act was designed to mitigate the asymmetry of information between Name and Agent, and consequent governance problems, which had inevitably increased with the number of outsider Names remote from the market. Syndicate accounting and audit had previously focussed on the other side of the market – the security of policyholders, reflected in the solvency of the syndicate – rather than on Names monitoring their Agents. The accounts were not published (some Names did not even receive accounts from their syndicates (Davison, 1987: 96); and 'until the post 1984 reforms no standard accounting or audit practices or rules in relation to disclosure ... applied' (DTI, 1990a: 47). No 'true and fair' opinion was given on the accounts by the auditors; and, crucially (as Section 2 below shows), 'auditors did not generally consider it part of their duty to enquire into the legitimacy or otherwise of reinsurances...' (DTI, 1990a: 48)). With reinsurance the insurer lays off part or all of the risks he has underwritten to a reinsurer. It was particularly in the area of reinsurance that, the DTI inspectors revealed, some agents were plundering Names' funds on a large scale in the period before the new regulatory regime.

The raft of measures incorporated in, and following, the 1982 Lloyd's Act required *inter alia* publication of syndicate accounts, standardisation of reporting practices, an auditor's 'true and fair' report and a statement of 'Disclosures of interests', detailing transactions or arrangements in which syndicate managers had an interest and in particular parallel underwriting, including 'baby' syndicates (see below). Also, associations between Lloyd's brokers and underwriters and related party reinsurance were banned. Macve (1986) provides a full discussion.

2. Costs and benefits

2.1. Private and social costs and benefits

In estimating the costs and benefits of the regulation heralded by the 1982 Lloyd's Act we consider two accounting units. The first comprises the collection of Names in the Lloyd's market. For them we ask whether, on a private calculation, the monitoring costs they incurred by introducing tighter regulation fell short of the benefits which regulation brought them. We calculate three types of monitoring cost: the extra expenditure on operating the regulatory unit of Lloyd's Corporation (REGCOST), the costs of complying with the regulation (COMPLICOST), and the costs of achieving the higher audit standards which accompanied the Act (AUDIT). On the other side of this account for the Names come, first, the benefits from preventing the haemorrhage of their funds through dubious practices by the agents, which was observed under the previous more permissive regulatory regime (PLUNDER). The second benefit takes the form of an expanded market, generating additional supra-normal profits for Names (LOSTBUS).

The second accounting unit is wider than just the Names, and the calculation corresponds more closely to social cost-benefit analysis as it is practised particularly in relation to large public sector infrastructure projects (see, for example, Layard and Glaister, 1994). In this case the costs are the same as for the private calculation: the costs of implementing regulation, of compliance and of audit do represent consumption of society's resources, and would enter a social cost-benefit analysis. On the benefits side, however, the calculation may differ considerably. A question arises whether PLUNDER should be included in the tally of benefits for society. One (polar) view would be that this is simply a transfer of wealth from Names to their less than honest agents; and such a transfer leaves the resources available to society as a whole unchanged. We explore this view below. If PLUNDER is excluded, the social benefit is limited to LOSTBUS, our estimate of the amount by which national economic activity is expanded (consumption possibilities increased) if effective regulation encourages the growth of the insurance market.[5]

2.2. Data

Our estimates of costs aim to represent the increment of costs above their 1981 level which can be attributed to the regulation heralded by the 1982 Lloyd's Act. The estimates are derived from several diverse data sources:

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[5] i.e. we are not faced with just a zero sum game of transfers among market participants, such as is analysed by Klumpes (2000).

Table 1
Costs of the regulator (REGCOST)

REGCOST = REGEMPLOYMENT * UNITCOST

REGEMPLOYMENT =

Number of extra employees in 1987 attributable to new accounting regulation
= 53

UNITCOST =

Costs per employee, incl. overhead, etc. in 1987 =

TOTALCOST/TOTALEMPLOYMENT

where:
TOTALCOST = total cost of regulatory services at Lloyd's (£000)
TOTALEMPLOYMENT = total employment in regulatory services at Lloyd's

=17252/451

=38.3

Basic estimate of **REGCOST** =
REGEMPLOYMENT * UNITCOST
= 53 * 38.3
= 2.03m in 1987

Alternative estimate of **REGCOST** =
REGEMPLOYMENT * 1.5UNITCOST
= 53 * 57.4
= 3.04m in 1987

Data sources: derived from KPMG (1988), Tables 2 and 3

a. the accounts of the regulator (the Corporation of Lloyd's);
b. a survey of a sample of Lloyd's agents carried out by a firm of management consultants soon after the regulation was changed;
c. the financial statements of a sample of 59 Lloyd's syndicates collected by the authors.

On the other side, we include as benefits:

a. the benefits to Names of not suffering the misappropriations of their assets which they experienced in the unregulated market prior to 1982. (The data on this plunder of Names' assets were constructed using the reports of DTI Inquiries and Lloyd's Disciplinary Inquiries). If successful in its aims the new regulation would eradicate these losses, to the benefit of Names;

b. conjecture about additional benefits realised by the market as a whole as a result of the investor protection afforded by regulation. Economic theory and econometric evidence for other markets suggest that the cost of capital will be lower where the investors are confident that their assets will not be plundered by their agents in the market; and this would stimulate economic activity.

The reliability of the estimates and the scope for judgment vary considerably from item to item of the cost-benefit analysis. We try in the text and particularly in the Appendix to make clear the areas of judgement and doubt and to indicate the sensitivity of the results to assumptions underlying the estimates.

2.3. Costs of regulation

We estimate three costs of regulation: the costs of the regulator; the internal costs incurred by the regulatee to comply with regulation; and the cost of additional external audit required by the new regulation.

2.3.1. Cost of the regulator (REGCOST)

The Lloyd's Corporation employed a substantial staff on regulatory activities and by 1986 the staff total had reached 450, costing £14m. p.a. including overheads (Duguid, 1988). While some of this expenditure was devoted to monitoring compliance with the 1982 Act (the focus of our analysis), the Corporation's regulatory activities extended much more widely, to include admitting members, approving and monitoring brokers and underwriting agents, and protecting clients (e.g. by monitoring members' premium limits and helping resolve client complaints). To estimate the additional burden of the new accounting regime we have analysed the growth from 1982 to 1987 in the various regulatory services departments at Lloyd's, using internal accounting information from Lloyd's disclosed in KPMG's (1988) management consultancy report. We have calculated from KPMG (1988) the increase in employees for each department which could have been involved in implementing the new syndicate reporting regime: advisory (14 more staff), accounting and auditing standards (16) and general review (12); we have added to this the 1987 total (not just the increment) of the fluctuating regulatory policy department – 11 staff. We have assumed that all these employees were the result of the new accounting and audit regime. And we have imputed per capita costs (salary plus overheads) on two alternative assumptions: first, for our central estimate, that they would be equal to the respective average for the regulatory services division as a whole; and secondly, for our upper estimate, that they would be 1.5 times the average, which might be the case if the additional employees included a higher proportion of (more expensive) professionally qualified staff. The resulting central estimate of REGCOST, the burden of the new accounting regulation, is £2.03m in 1987 prices. Table 1 expands the calculation and the Appendix discusses the underlying assumptions in more detail.

2.3.2. Compliance costs

- *Staff time, etc. devoted to compliance (COMPLICOST)*

Estimating the costs incurred by regulated businesses in order to comply with their regulatory obligations is more difficult than estimating REGCOST: it requires the regulatees' calculation and interpretation of unpublished accounting data for their businesses. Given the subjectivity of the interpretation, response bias may creep into the estimates (Moser and Kalton, 1971). For example, regulatees may resent the extra work imposed by regulation and exaggerate its extent in the hope that the burden will be reduced or eliminated. This problem is compounded by the difficulty of estimating which costs are incremental (see Franks et al., 1997): which costs would not be incurred anyway in a best practice business?

The difficulties have been illustrated by FASB:

> '...one Fortune 10 company testifying about the costs of a new standard on accounting for income taxes estimated the cost at 'one-half a man year to administer the rule'. Another Fortune 10 company, testifying on the same day, estimated 'the ongoing effort to require the equivalent of forty full-time employees, costing five to six million dollars annually' (quoted in Scott and Upton, 1991).

Then again, when the UK Securities and Investments Board (SIB) invited comments on the proposal to make custody an authorisable activity, 10 potential regulatees responded with concerns about the compliance costs. However, when the SIB's Cost-benefit Analysis Department contacted the firms to investigate and quantify these costs, all but two of the firms withdrew their comments (SIB, 1995). Yet again, in one of the very few empirical assessments of the compliance costs of accounting regulation (inflation accounting in particular), Carsberg and Page (1984) found considerable disparities in respondents' estimates.

Given these difficulties (exacerbated in our case by the elapse of time since the changes) we are fortunate that a survey of compliance costs was carried out for 1987 with the authority of Lloyd's by a leading management consultancy (KPMG, 1988). This provides estimates in 1987 of the share of compliance costs in total costs for the sample. We apply this share to the population's aggregate costs to estimate the population's compliance costs in 1987. Lacking direct evidence on the growth of regulatees' costs, we then assume that compliance costs will have risen *pari passu* with those of the regulator over the period 1981–7. Table 2 shows the calculation of a central estimate of compliance costs totalling £0.7m. Because the estimation procedure has scope for error, we also calculate a worst case estimate, of £2.8m.

- *External audit costs (AUDIT)*

The compliance costs calculated in the previous section do not include the cost of enhanced audit, which was a central plank of the reforms. We have therefore estimated directly the rise in audit costs as a result of the new regime by analysing the original syndicate accounts for a substantial sample of syndicates.

Additional audit requirements were introduced in stages. The requirement for audited accounts to be published applied from the closing year 1981, i.e. syndicates for which the final accounts would normally be published in 1984.[6] However, the requirement for a true and fair view opinion to be given did not apply until the closing year 1983, i.e. final accounts published in 1986. As explained in the Appendix, the method of allocating audit fee to individual years of syndicate account was complex and it did appear that the additional costs imposed by these requirements may not in fact have been disclosed until at least one year following the relevant closing year. A comparison of the audit fee for the closing 1981 year with that for the closing 1984 year, as published in 1987, was therefore

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[6] Syndicates were formally/legally constituted for one calendar year only, but their accounts would normally be left open for three years to capture receipt and settlement of claims before closure. Final accounts for a 1981 syndicate would then be published in early summer 1984. For further details as to the nature of syndicate accounting see Macve (1986), Macve and Gwilliam (1993).

Table 2
Costs of compliance for regulatees (COMPLICOST)

COMPLICOST = INCRECOST * 87COST

where INCRECOST =
the proportion of 1987 regulatees' costs which represent an increase over 1981,
assumed equal to that for the regulator's unit costs, i.e. 52% (derived in the Appendix)

87COST =
estimate of the regulatees' costs of complying with new and old regulation in 1987

$= (C_s/E_s) * E_p$
where C = compliance costs
E = total costs
$_s$ = sample
$_p$ = population

CENTRAL estimate of **COMPLICOST** =

INCRECOST * 87COST(CENTRAL)

= 0.52 * 0.0029 * 462

= 0.7m

MAXIMUM estimate of **COMPLICOST** =

INCRECOST * 87COST(MAX)

= 0.52 * 0.0116 * 462

= 2.8m

(See the Appendix for further details)

used as a basis for determining the additional regulatory cost.

The sample data used to estimate the incremental audit cost, AUDIT, were drawn from the random sample of 100 syndicates analysed by Macve (1986). Of the syndicates in the sample, 59 disclosed sufficient information for the 1981 closing year through to the 1984 closing year to be included in our series (the omissions are discussed in the Appendix). The external audit fees and gross premiums for the sample are aggregated in Table 3, which reports that audit fees per £1,000 of gross premium income rose for the sample from 97p for closing 1981 to £1.24 for closing 1984. AUDIT was calculated as the percentage increase for the sample in the audit fee to gross premium ratio between the 1981 and 1984 accounts, multiplied by the 1984 gross premium figure for the population, the market as a whole:

$$AUDIT_{84} = ((AF_s/GP_s)_{84} - (AF_s/GP_s)_{81})\ GP_{p,84}$$

where:

AF_s = audit fees for the sample
GP_s = gross premiums for the sample
GP_p = gross premiums for the population

This calculation, which attributes the whole of the 27p increase to the new regulation, yields a central estimate of £1.13m for AUDIT, with £1.8m as an upper estimate (see Appendix).

2.4. Benefits of regulation: private benefits from avoiding the misappropriation of investors' funds by their agents (PLUNDER)

2.4.1. Estimates

REGCOST, COMPLICOST and AUDIT all constitute, using Jensen and Meckling's (1976) agency theory terminology, additional 'monitoring' costs. These fall ultimately on Names, the principals in the Lloyd's market; and in return for this expenditure they would expect benefits in the form of reduced 'residual losses'. We identify the principal immediate benefits for Names as preventing subsequent residual losses which would arise from agents misappropriating (plundering) their funds. And we estimate the plunder which might be deterred by the new regulation using evidence on the plunder observed in the previous loosely regulated regime.

That there was such plunder under the old regime was confirmed in the colourful words of the Lloyd's chief executive who drove through the implementation of reforms: 'A handful of powerful insiders...had taken advantage of the Lloyd's climate of arrogant secrecy to milk their backers of millions' (Davison, 1987). But in ordinary circum-

Table 3
Increase in audit cost (AUDIT) attributable to regulation

1. Data required for the calculation: audit fees in relation to gross premiums, for the sample of 59 syndicates, in aggregate

Closing year	*Disclosed audit fee*	*Gross premium total*	
	AF_s	GP_s	AF_s/GP_s
1981	526,123	544,290,807	0.00097
1982	650,503	674,063,461	0.00097
1983	723,252	642,505,199	0.00113
1984	942,187	762,572,910	0.00124

Source: own calculations from sample of 59 syndicates' reports (see Appendix for further details)

2. Calculation of basic estimate of AUDIT

$$\mathbf{AUDIT}_{84} = ((AF_s/GP_s)_{84} - ((AF_s/GP_s)_{81})GP_{p,84}$$

$$= (0.00124 - 0.00097)\ 4{,}193\text{m}$$

$$= £1.13\text{m}$$

where s = sample
p = population

Population gross premiums obtained from 'Statistics Relating to Lloyd's 1987', London: Corporation of Lloyd's, 1988

Note: the '1984' figures are taken to be those reported and audited in 1987, and are therefore treated as being in 1987 prices

3. Upper estimate of **AUDIT**

For sensitivity analysis, an upper limit figure of £1.8m was calculated. See Appendix for details

stances, we, as outsiders, would not have been able to begin to quantify the extent of such misappropriation: on Davison's argument it could take place precisely because of information asymmetry. It was partly the happenchance of a Lloyd's agency being sold to a US company that precipitated a much more stringent audit on behalf of the purchaser that uncovered previously hidden malpractice. This provoked government investigation. And considerable information on losses sustained by outsider Names at the hands of insider agents (before the 1982 regulatory changes) was unearthed by the Inspectors appointed by the Department of Trade and Industry to investigate two business groupings:

1) P.C.W.Underwriting Agencies Ltd. (PCW) and W.M.D. Underwriting Agencies Ltd. (WMD)

The Inspectors were appointed following the discovery of a series of 'quota share' reinsurances of certain of the syndicates managed by PCW and WMD placed with a number of so-called 'reinsurers' in Guernsey, the Isle of Man, Gibraltar and Switzerland. The Inspectors reported (DTI, 1990b: 19) that these reinsurances had a number of common features:

a. They were on terms which were unusually favourable to the reinsurers.

b. They were operated in such a way that the premiums to the reinsurers greatly exceeded the claims on the reinsurers.

c. The ultimate reinsurers were under the control of certain directors of PCW and WMD.

The Inspectors calculated that the losses incurred by members of the syndicates as a result of these schemes totalled US$47.7m by 1982.

Other devices added to the losses to the syndicates. So-called 'baby syndicates' were employed: these could be used by managing agents and their associates to cream off the more profitable and less risky business, leaving the less attractive business in the 'main' syndicates in which the external Names also participated. The baby syndicates made profits of US$7.73m: '[T]he major part of these profits was obtained dishonestly' (DTI, 1990b:474). Then agency companies paid private expenses of directors, such as a yacht captain, gardeners, etc. These devices are summarised in Table 4. The table excludes an 'Intermediate Program' investigated by the DTI,

Table 4
Estimates of detected PLUNDER (1982 prices)

1. Minet Holdings plc and WMD Underwriting Agencies Ltd	
a. syndicate losses from quota share schemes*	US$5.3m p.a.
b. dishonest profits from baby syndicates**	US$0.4m p.a.
c. private expenses paid by agencies***	UK£50K p.a.
2. Howden	
One example: diversion from Lloyd's syndicates****	US$4.93 p.a.

*Total by 31.10.1982 = US$47.7m
Source: DTI (1990b), p.160, para 6.30

**Total = US$3.8m
The inspectors reported that 'the major part' of US$7.73m was dishonestly obtained. We have interpreted this conservatively as 50% of the total.

***Relates just to estimates for 1978–81. Earlier figures could not be established
Source: DTI (1990b: paras. 14.23 and 15.2)

****Total (1980–82) = US$14.8m
Source: DTI(1990a)

which also produced losses for the syndicates, but ones which were 'hard to estimate', though 'comparatively small compared to the losses as a result of the quota shares'.

2) Alexander Howden Holdings plc

> The Inspectors were appointed to investigate irregularities discovered by Alexander and Alexander after it took over the Howden Group. The irregularities included the diversion of funds from Names to the private use of directors of managing agents. The Inspectors' Report (DTI, 1990a) does not yield a precise total of the funds diverted from Names as readily as the Report for PCW/WMD. From among the schemes outlined in the DTI Report we have therefore chosen to concentrate on just one representative diversionary scheme analysed by the Inspectors, where the diversion from Names can be unequivocally and precisely identified.

Under this particular scheme:

> 'Certain Howden managed Lloyd's syndicates paid substantial reinsurance premiums to ... companies [owned and controlled by Howden directors and their associates]. The terms of the reinsurances appeared normal, but the resulting funds were not retained by the ... companies to meet later claims. They were used, *inter alia*, to fund the purchase [for the Howden directors and their associates] of substantial personal interests in the Banque du Rhone.' (DTI, 1990a: 30)

This diversion took place in 1980–82. It totalled $14.8m, i.e. an average of $4.93m p.a. (see Table 4).

2.4.2. *Error and bias in the benefit estimates yielded by PLUNDER*

The figures we have prepared for PLUNDER differ from those generated in the respective DTI reports in two material ways. First they exclude accumulated interest forgone on the misappropriated funds by the respective Names from the time of each instalment of plunder to the Inspector's reckoning date (1982). Second, our figures for PLUNDER do not deduct recoveries of Names' monies following investigations of the scandals. These additions and deductions were appropriate for the DTI inspectors, interested in a cumulative total for the funds of which Names were deprived over time. But we have a different measurement objective. We are instead calculating annualised misappropriations for comparison with annual outlays on regulation designed to eradicate such misappropriations. We are using the data to estimate the value of future plunder prevented by the new regulation – deterred by the prospect of the agents being found out as a result of the new monitoring devices.

We are effectively assuming that the annual plunder we identify under the old regime (a) would not normally have been recovered with the monitoring mechanisms then in place, (b) would have continued at at least that rate in the absence of regulatory change, but (c) would be effectively deterred under the new regime. How heroic are these assumptions?

In respect of assumption (a), institutional monitoring mechanisms in place in 1982 did not seem to be adequate to detect such misappropriations. In the Howden case, for example, and indirectly PCW too, the plundering of syndicates was unearthed almost by chance, following the takeover of the errant agent (Howden's US acquirer was required by SEC rules to audit the subsidiary): it had proceeded for some years without detection during routine audit to Lloyd's pre 1982 standards. This is not surprising given the restricted scope of the audit at that time (see 2.3.2 above); as the chief executive of Lloyd's acknowledged, the auditors 'were not charged with performing an audit to normal auditing standards ... they did not see it as part of their duty to draw their Names' attention to what was happening'(Davison, 1987: 54).

In respect of assumption (b), the observations of the Lloyd's chief executive suggest that our estimates of the annual rate of PLUNDER which might have continued are actually too modest. The figures revealed by the official inquiries might represent only the tip of the iceberg. We have not included in our estimates other cases, some of which came to light as a result of the chance discoveries mentioned above. Davison (1987: 60) reports the case of Brooks and Dooley – which was the subject just of an internal investigation: around £6m went astray. Gwilliam et al. (2000) analyse the reports of a series of Lloyd's Disciplinary Inquiries which give further confirmation that these were not isolated cases: the Janson Green Inquiry (8606/1) revealed syndicate losses of just under $2m between 1976 and 1983 from inadequate interest returns on an offshore funding policy; the CLR Hart Inquiry (8501/9) showed that two syndicates were deprived of some $1.6m. in the early 1970s and further (smaller) amounts subsequently; and the Denby and Posgate Inquiry (8403/4) led to the repayment of £2.3m in 1983 following a dispute about the apportionment of a funding policy between syndicates (the preferential treatment of one syndicate). Moreover, Davison describes some 'doubtful arrangements', breaching the laws of agency, as affecting 'syndicates covering 92% of the total membership of Lloyds'(p.62). And again, in relation to baby syndicates, 'many...adopted the practice of operating a preferred syndicate to reward agency directors or staff' (p.62).

Moreover, we are implicitly assuming that, in contrast with our estimates of the cost of eradicating PLUNDER – where we estimate that costs grew in line with the market – PLUNDER would only have continued at its previous *absolute* level if regulation had been unchanged. If it had actually risen *pari passu* with the growth of the market, then our estimates of net benefits from regulation would again be biased downwards.

Taking (a) and (b) together then, there is some justification for taking gross misappropriations, without deduction for recoveries, as our measure of PLUNDER – our estimate of future misappropriations which might be deterred by the new regime.[7] Moreover, our estimate is likely to understate actual plunder; but because the rest of the 'iceberg' was undetected we cannot adjust our figure.

What of assumption (c)? Would the new accounting regime have made such misappropriations transparent and thereby have deterred potential plunderers? Certainly the new regime was designed to detect just such misappropriations (see the Introduction, above). And the plunder we have described was itself detected by an audit because the relevant agency had been taken over by a business under the jurisdiction of the SEC, which, unluckily for the agents, stipulated such investigation. In practice the new system has not unearthed further scandals similar to Howden and WMD. There remains the logical possibility of course that plunder has continued unabated but undetected: this is, inevitably, a proposition we can never falsify empirically.

2.5. Standardising the estimates: time period, currency and prices

Table 5 reports our attempts to consolidate the diverse estimates of Tables 1 to 4. In preparing Table 5 we have standardised our earlier estimates in three ways, by:

1. calculating flows estimated for various periods on a per annum basis;
2. converting all flows into a common currency;
3. converting all flows into a common price level.

We outline each of these steps in turn.

1. A per annum basis
   Tables 1 to 4 have provided estimates for a variety of time periods, depending on the source. To achieve like with like comparison we have converted each of these onto an annual basis. Mostly this has involved simply assuming the flow was uniformly distributed across time; though in the WMD case we apportioned it according to the number of quota share schemes in operation in each year (this produced a maximum annual misappropriation of 1/9th of the total (for six years) and a minimum of 1/18th (also for six years).

2. Common currency
   Some of our estimates have been in US$ (most Lloyd's business is transacted in dollars), others in pounds sterling. We have converted all dollar

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[7] Had we been aiming for a different calculation – of the *ex post* costs of the deception of Names, rather than our objective of estimating future plunder which might be deterred, then, as well as deducting recoveries from PLUNDER, we should have had for completeness also to add back the costs of the investigations by the US acquirer, by Lloyd's and by the DTI which were necessary to elicit the recoveries. We have no data on these costs, but they are said to be significant (Duguid, 1988:63).

Table 5
An interim account of private costs and benefits for Lloyd's Names of the new regulation

	£1,987m per annum	
	Central estimate	*Upper estimate*
COSTS		
REGCOST	2.03	3.04
COMPLICOST	0.70	2.80
AUDIT	1.13	1.80
Total costs	3.86	7.64
BENEFITS		
PLUNDER	7.70	?

Source: Tables 1 to 4, with the adjustments explained in the text.

figures into pounds in the year for which the Inspectors calculated their totals, 1982, at an exchange rate of 1.75 (CSO, 1993: Table 32).

3. Common price level
   The initial estimates in the tables above are all in current prices at diverse dates. The underlying flows occurred at a time of significant and varying price inflation. All estimates (after conversion to sterling) have therefore been converted to 1987 prices, using the retail price index (CSO, 1993: Table 25).

Thus REGCOST, COMPLICOST and AUDIT transfer, unamended, from Tables 1,2 and 3 respectively: they were all recorded in £1987. For PLUNDER the estimate of $10.63m (plus £50k) in 1982 translates to £6.11m in 1982 prices, which corresponds to £7.70m in 1987 prices (the latter being 1.26 times their 1982 level).

2.6. Did the new regulation bring more private benefits than costs to Lloyd's Names? – interim estimates

Table 5 standardises the estimates of costs and benefits from Tables 1 to 4 in an attempt at an interim measure of the net cost or benefit of the regulatory change to Lloyd's Names collectively. For each of the categories of monitoring cost we have two estimates, a basic, or central, one (the one we think most likely), and an upper estimate representing an unlikely worse case. The total costs on the central estimate are £3.86m p.a. in 1987 prices. Our estimate of the benefits accruing to Lloyd's Names, on the other hand, is £7.7m p.a.; and we have argued that this is likely to be an under-estimate, although, in contrast with the cost categories, we cannot readily quantify an alternative case.

If these figures are accepted, then, it seems that, in Jensen and Meckling's terms, these private benefits to Lloyd's Names collectively of enhanced monitoring exceeded their private costs by a considerable margin (taking the worst case throughout leaves costs and benefits roughly in balance) – leaving aside the further benefits we introduce in the next section. This raises the question (pursued in Gwilliam et al., 2000) why, if we believe the central estimates which show it so clearly paid the Names collectively, self-regulation was not introduced much sooner – why agents were not driven by market forces to expand self-regulation before the 1982 crisis broke.

One possible answer is that, because of information asymmetry with weak monitoring, Names were unaware of the residual losses being imposed upon them by dishonest agents. So it was not evident to them that extra expenditure on monitoring would have been worthwhile.

A second answer is related to the same information asymmetry problem. The climate of secrecy was associated with weak governance procedures. Agents (including some of those most active in misappropriation) were prominent in the governance of the Lloyd's market. And *their* interests may well have been furthered by the status quo, even if the Names' interests were not (Gwilliam et al., 2000).

There may also have been a coordination problem. Those best able to lobby for increased self-regulation would be internal Names. But the proportion of internal Names in the total was falling as new external Names, including foreign ones, were deliberately recruited (see above). Lobbying for increased self-regulation imposes costs on the lobbyer (especially time). If these costs fell disproportionately on the internal Names, while the benefits (inevitably) accrued to all Names, it would be expected that these lobbying efforts would be 'under-provided'; and this problem would have been exacerbated by the opening up of Lloyd's.

In the end, even though we argue that self-regulation was already well worthwhile, it was government, represented particularly by the Bank of England, which applied the pressure for the new regulation. We would not, however, argue that this was just because the Bank perceived that Names' private interests would best be served by this extra monitoring, and acted paternalistically to protect them. Rather it was because – in reacting to a crisis – it wished to take action to secure further benefits which might be achieved through greater transparency in the Lloyd's market – benefits which, unlike PLUNDER, had a definite social counterpart in expanding the national economy. These are the subject of the next section.

2.7. Further benefits of accounting regulation: avoiding the loss of business from the market (LOSTBUS)

A key theoretical issue in identifying the social benefits from better informed markets is analysed by Akerlof (1970) in his classic 'Market for "lemons"' paper:

> 'Consider a market in which goods are sold honestly or dishonestly: quality may be represented, or it may be misrepresented. The purchaser's problem, of course, is to identify quality. The presence of people in the market who are willing to offer inferior goods tends to drive the market out of existence ... It is this possibility that represents the major costs of dishonesty – for dishonest dealings tend to drive honest dealings out of the market. There may be potential buyers of good quality products and there may be potential sellers of such products in the appropriate price range; however, the presence of people who wish to pawn bad wares as good wares tends to drive out the legitimate business. The cost of dishonesty, therefore, lies not only in the amount by which the purchaser is cheated; the cost must also include the loss incurred from driving legitimate business out of existence.' (p.495)

Akerlof specifically applies his analysis of 'adverse selection' to the insurance market. When the potential insurer (the Name in our analogous case) has less information than the applicant for insurance about the applicant's riskiness, mutually beneficial deals may not be done: if the insurers cannot tell the difference between a good risk and a bad risk, bad risks will be offered the same terms as good risks; insurance will then be attractive to bad risks but not to good, and only those with bad ones will enter the market. This is unsustainable for the insurer. As Lev (1988: 7) explains for the corresponding case in the equity market:

> 'At the extreme, suspecting gross information asymmetries, uninformed investors may quite rationally withdraw from trading ... altogether. ...A massive withdrawal of uninformed investors from the market will ... deprive the economy of the allocational and risk-sharing benefits of large and efficient capital markets.'

The 'purchaser's problem ... to identify quality' had, of course, long been recognised at Lloyd's insofar as it affected the policy-holder, for whose protection substantial regulation, including an audit of syndicates' solvency, was in place well before 1982. But Akerlof's argument applies symmetrically to the other side of the market: the contract with the Name who ultimately assumes a share of the risk of the policy-holder. If the dishonesty of the intermediaries means that no matches can be found between 'potential buyers of good quality products [prospective policy-holders] and ...potential sellers [Names] in the appropriate price range', Names are lost and Lloyd's capacity reduced. Business will be driven either to other insurance markets – domestic or overseas – or 'out of existence' altogether. In the latter case this means that some risks will not be insurable, and this can curtail economic activity. For example, an activity which is worthwhile on an expected value calculation, but which carries a modest risk of total ruin for the participants in one possible adverse state of the world, may not be undertaken at all if the participants cannot share the risks of the adverse state of the world via insurance.

Although the link between trust in information and willingness to trade has been prominent in the discussion of falling equity markets following the Enron, Xerox and WorldCom accounting scandals (Meeks, 2002), quantifying these costs of business lost because of the deterrent effect of information asymmetry (the 'major costs' of dishonesty, in Akerlof's view) is not straightforward (see Meeks and Meeks, 2002); and we are aware of no attempts in the accounting literature on regulation. A related question is posed by Healy et al. (1999). They focus on individual companies which **voluntarily** increase their disclosures to the capital market. They ask whether more candid disclosure by managers yields benefits, as Akerlof would predict. And their empirical analysis concludes that there are indeed beneficial effects from voluntary disclosure – on the cost of capital and on other indicators of capital market approval such as increased institutional ownership and analyst following, as well as reduced bid-ask spreads.[8]

The approach of Healy et al. cannot readily be applied to Lloyd's for two reasons. First, it relies on the diversity of experience across firms (those disclosing can be compared with those which do not); whereas the Lloyd's regulation affected all participants in the market. And second, of course, it relies on data on share prices, which are not available for Lloyd's. An alternative econometric analysis of the beneficial effects on market activity of extra information disclosure is offered for manufacturing industry by Swann et al. (1996). They assess the impact of product standards in manufacturing upon the level of trade enjoyed by suppliers under the jurisdiction of the standard-setting body: in particular the growth of the international trade of the affected industry when the British Standards Institute published standards. One of their models implies for example that an additional 100 'idiosyncratic' standards (as opposed to internationally adopted standards) would improve exports by somewhat more than 48%.

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[8] Results which are consistent with the earlier work of Botosan (1997) and of Welker (1995). See also Lang and Lundholm (2001) and Lundholm and Myers (2002).

The innovative studies by Swann et al. and Healy et al. benefited from much richer data than are available for Lloyd's on the diverse experience of different participants in the respective markets. They do provide background support for Akerlof's proposition that dishonesty may have major costs, or honesty benefits. Given the paucity of data available for Lloyd's, we have stopped short of providing any estimates of the corresponding gains at Lloyd's – for fear they might be quoted without the huge disclaimers which must be attached to them, and might have imputed to them a precision which would be unwarranted. However, simply to suggest the orders of magnitude which may be at issue, consider just one component of the gains from extra trade enjoyed by Lloyd's Names following these regulatory changes: the rise in supra-normal profit, where this is defined as the additional profit earned by Names over and above the 'normal', or competitive, returns which would have been available on alternative investments.

This might be a suitable indicator of one component of LOSTBUS in the hypothetical circumstances where Lloyd's was able, as a result of the regulatory changes, to provide insurance contracts on terms which would yield its competitor only a normal rate of return, but yield Lloyd's a superior rate of return – because of some intrinsic competitive advantage enjoyed by Lloyd's. In this hypothetical case the service provided to clients would be identical; but profits would be higher if it were delivered by Lloyd's than if it were supplied by the rival. Its provision by Lloyd's would therefore be Pareto superior (Lloyd's Names would be better off, the rival's owners need be no worse off since they could obtain identical (competitive) returns elsewhere in the economy).

The assumption, then, is that, from the extra gross revenue generated by Lloyd's, suppliers are paid the market price for their goods or services – these representing their opportunity cost. Similarly, the normal rate of return on the capital invested by Names in Lloyd's also represents its opportunity cost – what it could earn in a similar alternative use. The residual – supra-normal profit – then represents the addition to society's consumption possibilities afforded by the extra business transacted by Lloyd's. This is treated as a social gain. And in this case it is captured by Lloyd's Names.

The same approach might be adopted where, as a result of the regulatory changes, Lloyd's were able to exploit their competitive advantage, and insure against some risk which other insurers would not contemplate, thereby allowing an extra economic activity to go ahead because its owners could now share a serious risk. It might be that Lloyd's captured all the benefits in supra-normal profits, which would then proxy for LOSTBUS. But some of the gains might accrue to other participants in the activity (the next section discusses consumer surplus, for example); and then Lloyd's supra-normal profit could seriously understate the social gains represented by LOSTBUS.

If the growth in supra-normal profit were a legitimate measure of LOSTBUS in real life, what would be its order of magnitude? The work of Aczel et al. (1990) suggests that perhaps three-eighths of Lloyd's total return represented supra-normal profit.[9] The aggregate profit level in 1986 was £750m. (Rew and Sturge (1989), quoted in Gwilliam et al., 1992:227). And Lloyd's business had been growing by around 20% p.a. since the 1982 reforms (Duguid, 1988).[10]

One reason we stop short of moving from these (very large) indicative numbers to direct estimates of LOSTBUS is that such figures might not be straightforwardly attributable to the new regulation – the implicit *post hoc, ergo propter hoc* reasoning is open to challenge. First, Lloyd's business was in any case already growing strongly before the 1982 reforms, because of a deliberate effort by the market to recruit new Names. For this reason, raw figures of the growth in business would *over*-estimate any beneficial impact of regulation. Second, ironically, the scandals which had taken place prior to 1982 and gave rise to PLUNDER were only disclosed in 1982, just as Lloyd's was installing a regulatory regime designed to prevent them. This bad news would be expected, other things equal, to depress business and mean that post-1982 growth figures *under*-estimate the impact of regulation (compared with a situation where the extent of dishonesty had been fully recognised beforehand and only the favourable news of improved disclosure was released in 1982).

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[9] 8% obtainable at Lloyd's and 5% obtainable on other similar investments (Aczel et al., 1990).

[10] Though, because of profit's greater volatility than business, this is an imperfect proxy for the growth of profit.

With such qualifications over the inferences which may reasonably be drawn from such numbers, we do not present precise figures attributable to the reforms; but we do suggest that this component of the cost-benefit analysis may be very significant indeed.[11]

2.8. Calculating net social costs or benefits

If we tried to prepare a table equivalent to Table 5, except that it represented the *social* costs and benefits, how would it compare with the interim private figures in Table 5?

The three costs we attributed to regulation in Table 5 would be included here too: REGCOST, COMPLICOST and AUDIT all represent consumption forgone by society in order to provide monitoring.

However, there is doubt about whether, or how much of, PLUNDER should be included in the list of social benefits. Some would argue that this figure should be ignored altogether, on the grounds that it does not represent the use of society's resources: it is just a transfer where the Names' losses are exactly matched by the Agents' (illicit) gains. This is a standard problem with conventional cost-benefit analysis of projects which redistribute income – where there are gainers and losers. And the view that the gains and losses net out is often associated with the Hicks-Kaldor criterion: that redistribution is neutral if the winners could compensate the losers – even if they do not (see Layard, 1972). However this stand on interpersonal comparisons has not gone unchallenged. An alternative view is that weights might be assigned to the different groups – for example taking the view that a pound in the hands of a plundered Lloyd's Name counts more than a pound in the hands of a plundering agent. Given suitable weights, a revised 'social' figure for PLUNDER could be calculated. This takes us into fraught areas of social welfare (see Bromwich, 1992), which we cannot hope to resolve here; we can only leave readers to assign their own weights.

The remaining benefit to enter the social cost-benefit analysis, which did not appear in the interim figures of Table 5, is LOSTBUS. If this turned out to be anything more than a small fraction of the huge indicative sums we suggested in the previous section, then Akerlof's contention, that it is the main benefit of honesty, would be borne out; and the change in regulation would have produced positive net social benefits, even if PLUNDER were seen as a zero sum game, and discounted completely. Supra-normal profit will inevitably be an imperfect measure of the social impact of LOSTBUS. On the one hand, it will *under*-estimate the LOSTBUS benefits to society to the extent that these benefits are shared with the client – if the client gains a price advantage by trading with Lloyd's then some clients who would have paid the higher price offered by Lloyd's rival will gain, as well as Lloyd's. This consumer surplus is, of course, notoriously difficult to estimate. (Or again, the client might benefit because, as is indeed sometimes the case, Lloyd's will insure against a risk which other insurers will not consider.) But, on the other hand, the supra-normal profit measure will *over*-estimate the social benefit, LOSTBUS, to the extent that it originates from, say, tax privileges enjoyed by Lloyd's (of which there are indeed significant examples), or from monopolistic market power derived from entry barriers (which again there are likely to have been). We cannot therefore be confident that supra-normal profit is the appropriate sole measure for LOSTBUS. But it is still clear that we are dealing with an order of magnitude that swamps our cost calculations.

3. Conclusions

This paper has had two aims. First, we have tried to advance the methodology for cost-benefit analysis of accounting regulation, a field in which there is a huge gap between aspiration and achievement, among both academics and practitioners. Second, we have been supplying a new, quantitative perspective on a major change in monitoring in a very significant financial services industry. The aims have been intertwined. Lloyd's offered a historical shift and a set of data which are particularly valuable in exploring ways of quantifying the costs and benefits of regulation generally. And quantifying those costs and benefits helps in interpreting the behaviour of Lloyd's and, for example, of the Bank of England, in the upheavals of the early 1980s.

We have adopted two approaches to cost-benefit analysis. First we considered just the immediate interests of the investors in Lloyd's, the Names. We asked whether, in principal-agent terms, the cost of the extra monitoring of agents introduced in the early nineteen-eighties was warranted by the benefits for the principals. And we developed measures of regulatory costs, compliance costs and audit costs, to set against the estimated gains from deterring residual losses – the plunder of Names' assets under information asymmetry. Our preferred estimates[12] suggest that, on this interim calculation alone, the regulation was well worthwhile – that it would have been rational for Names to adopt it earlier, had they been aware of these facts. And this conclusion was reinforced when we brought into account a further impact of reform, additional supra-normal profit. However, this produced tantalising difficulties. On the one hand it introduces extra benefits which, on theoretical grounds, we might expect to swamp those in the interim calculation. On the other hand, the measurement difficulties are formidable; and we have not advanced beyond suggestive evidence on orders of magnitude, buttressed by evidence from other fields.

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[11] And that some thorough econometric analysis of the link (beyond the scope of the present paper) could be rewarding.

[12] If our worst case estimate were substituted for every variable, the conclusion would be ambiguous.

Our second approach adopted a different accounting unit, in which social benefits are taken into account. Shifting to the social dimension also introduced tricky social welfare questions over a benefit which was uncontroversial in the private calculation: whether deterring plunder of one person's assets by someone else actually raises welfare. Our discussion was inevitably tentative; but, even if we take, as an ethical view on interpersonal comparisons, that a pound in a dishonest agent's pocket is worth the same as the pound lost by the plundered Name, we are inclined in the Lloyd's case to agree with Akerlof's general suggestion that there will remain the major benefit of extra honesty induced by regulation – inducing a bigger market; and that this benefit is potentially very large indeed in relation to the costs we have identified.

While we have argued here the case that the regulatory reforms we have examined at Lloyd's more than justified their cost, on a private or a social calculation, this does not imply that such appraisal itself underlay the historic decision to introduce them. Why the Lloyd's market had itself failed to act to introduce the controls necessary to match the increasing separation of ownership and control as the number of Names rapidly increased is itself a historical question for investigation (Gwilliam et al., 2000). Nor are we arguing that the particular style of regulation ('self-regulation') and the form of accounting and auditing change adopted were necessarily those most suited to the Lloyd's environment. They were modelled closely on the established pattern of requirements for limited company accounting and audit, with the minimum concessions possible being made to the unique features of Lloyd's market structure and organisation. This has left unresolved, *inter alia*, a number of major issues as to how the syndicate accounting regime and market structure can secure 'equity' between Names – but adoption of this 'off the peg' solution itself appears to reflect the ways in which the model of corporate accountability has become deeply embedded in business, organisational and social structures over some 150 years of evolution (Gwilliam et al., 1992; Power, 1999). As Akerlof would predict, the primary benefit of the new regime at Lloyd's has probably lain in 'opening up' a market whose traditional culture was one of exclusiveness and secrecy (in part fuelled by the generous tax concessions that Names used to enjoy (Ackzel et al., 1990)), so that 'the external members of Lloyd's could be their own police force' (Davison, 1987: 6–7).

That the incremental benefits of the new regulatory requirements exceeded their costs seems clear; but this is not to say that the existing regulatory structures to which they were added were themselves cost-effective, so our arguments here do not in themselves imply any judgement on the overall efficiency and effectiveness of the regulatory regime in force at Lloyd's. And we have here only examined the impact of the major regulatory changes in the years following 1982 that were primarily directed to restoring belief in the 'honesty' of the market. Later events were to show that the regulation then introduced could not prevent the consequences of poor underwriting judgment or the problems of lack of information to monitor systemic accumulation of risk.[13]

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[13] It has therefore more recently been argued that the objective of regulation at Lloyd's should be restated as 'to provide reasonable safeguards ... to establish a basis for confidence that Lloyd's is a solvent and soundly managed market in which to do business' (Hardcastle, 1997).The precise form of, and the limits that should be set to, the continuing expansion of Lloyd's regulation – now the responsibility of the Financial Services Authority (FSA) – remain problematic pending further investigation.

Appendix

Assumptions underlying the cost-benefit calculations

The period over which we have estimated the incremental costs and benefits of the major syndicate accounting and audit reforms is 1982 to 1987. This spans the time between the Lloyd's Act of 1982 and the report of the Neill inquiry in 1987, the objective of which was to provide Names with similar protection to that provided to investors by the Financial Services Act 1986. In response to the Neill Report (1987), Lloyd's introduced further reforms of reporting, commencing with a revised Syndicate Accounting Byelaw (No. 11 of 1987), effective from the 1988 operating year. (The details are analysed in Macve and Gwilliam, 1993.) The KPMG report (1988) provides information spanning the same period.

A.1. REGCOST

Lloyd's expenditure on regulatory services (ERS) rose from £3.6m in 1981 to £17.2m in 1987. Over the same period net premium income (NPI) rose from £1,859m to £3,935m (KPMG, 1988). Regulation costs per pound of premium income (ERS/NPI) therefore rose from £0.0019 to £0.004. If the unit cost of regulation had remained constant, then total regulation costs would have risen to £7.5m by 1987 (0.0019 x 3935m). The increment of regulatory costs not attributable just to the growth in the market being regulated (17.2 – 7.5) cannot, however, be assigned exclusively to the new accounting regime, since several departments within Lloyd's regulatory services dealing with matters unrelated to the new accounting regime were experiencing growth faster than that of the market in these years (KPMG, 1988). We have therefore limited the costs attributable to the new accounting regime to the incremental costs of those regulatory departments which had some involvement with syndicate accounting and audit. Had a finer disaggregation been available, our estimate of REGCOST in Table 1 would probably have been smaller.

A.2. COMPLICOST

a) INCRECOST is assumed equal to the rise in regulator's costs divided by final regulator's costs reported above (((0.004 – 0.0019)/0.004) = 0.52).

b) 87COST

Table A.1 reproduces Appendix V of KPMG (1988) which lists the compliance costs estimated by the sample of five Lloyd's agents surveyed by KPMG. Much of this expenditure is likely to be associated with regulation of the product side of the market – protecting the policy-holders – rather than regulating relations between Names and agents, which is the focus of this paper. Two of the account headings clearly fall outside the regulation we are considering: 'efficiencies in LPSO', which is connected with Lloyd's internal service for recording contracts; and 'non mandatory E&O' which relates to general insurance arrangements. For our upper bound estimate we have included every other account heading in Table A.1, resolving all areas of doubt by ascribing costs to regulation of Names-agents relations, rather than Lloyd's-policy-holder relations. This yields a total cost for the sample of £322,000, which is 0.0116 of the sample's total agency and syndicate expenses. At the other end of the range, we have included just those expense headings which are likely to include a good deal of expenditure resulting from the new accounting regulations to protect Names: 'accounts', 'solvency' and 'solvency and globals'. These amount to £81,000 for the sample, 0.0029 of total expenses.

Applied to the aggregate expenses figure for the population in 1987 of £462m, the resulting central estimate for 1987 is £1.34m, the worst case estimate is £5.36m.

The order of magnitude suggested by Table A.1 for the ratio of aggregate compliance costs to total agency expenses is confirmed by a later KPMG study for Lloyd's, summarised in Hardcastle (1997, ch. 9 and Appendix 3).

KPMG notes, however, that the costs of time (especially senior management time) spent on compliance with regulatory requirements may not capture the full opportunity cost of diversion of staff resources from undertaking profitable business activity and development.

A.3. AUDIT

Although this estimate is based on actual disclosed audit figures it is not unproblematic in either its calculation or its interpretation. Of the 41 'missing' syndicates the majority may be accounted for because they started or closed in the period under examination and therefore a full run of data was not available, or because the appropriate disclosures could not be traced (for example where audit fees were charged direct to Names' personal accounts). However, 17 related to syndicates with accounts in 'run-off', i.e. where accounts for one or more of the syndicate years is not closed at the end of its third year. Frequently run-off years are associated with cessation of the syndicate although syndicates may have opened subsequent years. Either because of cessation or because the open years continued to accrue audit charges these syndicates were excluded. In that the run-off syndicates tended to be large and in a particular sector of the market, non-marine, this may introduce a degree of bias into the sample. Run-off years typically incur heavy audit costs (although run-off accounts were excluded from the true and fair view audit requirement). A later Byelaw did impose additional duties on auditors with respect to run-off accounts, but these were not introduced until 1989. In these circumstances, the extent to which the high audit fees associated with run-off accounts may be attributed to the impact of regulation in the period under examination is extremely difficult to determine and provides additional grounds for leaving them out of the calculation of the incremental cost.

A separate issue is that the accounting policies used by syndicates to attribute audit costs to particular years were not uniform. For a conventional syndicate without accounts in run-off, the audit will cover two open years and one closed year. The majority of syndicates appear to attribute by far the greater proportion of the audit cost to the second open year with relatively little attributed to the opening or closing years. Whether this reflected actual work done or the pattern of premium income and claims is not clear. Conflicting signals are also provided in the syndicate accounts as to the policy adopted with regard to accruals. It appears that the audit fee for a closing 1981 account would have reflected the actual audit work carried out in 1983 on an accrual basis, or in 1982 on a non-accrued basis. This does rather suggest a lagged response in the disclosures and supports the use of the 1985 closing year figures (reported in 1988) as another comparison point. Extending the analysis to 1985 indicates that for the 49 syndicates for which data from 1981 through to 1985 is available, audit fee per £1,000 of gross premium rose from 93p to £1.36. (A still higher measure of additional cost could be obtained by comparing the 1980 figure of 82p (for those 37 syndicates which disclosed the comparative audit fee figure in their 1981 accounts and for which data through to 1985 are available) with the 1985 figure for these syndicate accounts of £1.65. However, the voluntary nature of the 1980 disclosure may well make this comparison an unreliable one.)

The third issue is whether it is appropriate to attribute all the increase in audit cost per premium pound to increased regulation. It may be that other factors were driving the increased cost: on the supply side the small firms of 'panel' auditors were being absorbed into larger firms; on the demand side 'agency' arguments would suggest higher quality audits being demanded as the divorce between 'ownership' of syndicates and their control grew wider (see Gwilliam et al., 2000, for further discussion of this issue).

Appendix Table A.1
KPMG estimates of costs of compliance

Category of cost	*Time* £000	*Outlays* £000
GENERAL AGENCY		
Compliance officer	32	0
Non-mandatory E&O	0	340
Ownership/financial resources	0	2
Directors (non-execs/approval)	8	5
Excess reg change	8	3
Committees/courses	30	0
Sub-total	78	350
MEMBERS' AGENCY		
New agency agreement	19	5
Names' recruitment	14	0
Excess means checks	9	0
Accounts	19	9
Solvency	8	31
Other letters to Names	4	1
Special reserve fund	15	1
Information to Names	31	46
Sub-total	119	93
MANAGING AGENCY		
Quarterly figures on network	4	1
Accounts	3	2
Stamp on network	3	0
Solvency and globals	6	3
Efficiencies in LPSO	0	771
Sub-total	16	777
TOTAL	**213**	**1,220**
TOTAL EXPENSES AND TIME COSTS		1,433
Total syndicate and agency expenses		27,765
Proportion of compliance to total costs – %		5
Proportion of compliance (excluding LPSO) to total costs – %		2

Source: reproduced from KPMG (1988)

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An investigation into the measurement of graph distortion in financial reports

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Abstract—The Graph Discrepancy Index (GDI), which originates from the lie factor introduced by Tufte (1983), is the mechanism commonly used in the financial graphics literature to determine whether graphs are distorted and to quantify the extent of such distortion. Although the GDI is critical to the financial graphics literature, little or no attention has been paid to its robustness and accuracy. We critically examine the mathematical characteristics of the GDI and show its limitations as a measure of graph distortion. We review a number of cases to demonstrate these limitations and present an alternative measure of graph distortion – the Relative Graph Discrepancy index (RGD). Numerous simulations suggest that the RGD overcomes the problems associated with the GDI. The RGD is also tested on data presented in earlier research and the results are compared to those obtained using the GDI. In comparison with the GDI, we find that the RGD is more consistent and produces slightly stronger results. We stress, however, that this is not a best or definitive measure but is intended to start a research process that leads to a generally accepted measure.

1. Introduction

The increased use of graphs in financial reports, the effects of graphs on users' perceptions and the incentives for managers to distort graphs to convey a favourable impression have resulted in considerable research using the graph discrepancy index (GDI) to investigate the distortion of graphs in financial reports. This paper investigates the robustness of the GDI and is motivated by the fact that, while the GDI is critical to this research, little or no attention has been paid to its accuracy in determining whether graphs are distorted and its reliability in quantifying the magnitude of such distortion.

The content of communication between companies and their various stakeholders, and the incentives to manipulate the content of annual reports or manage the impression conveyed has been the subject of considerable research (for example, Gibbins et al., 1990; Revsine, 1991; Graves et al., 1996; Preston et al., 1996). An important part of this literature relates to the communication of financial and other information via graphs. There has been extensive research into selectivity in the choice of financial graphs to be included in annual reports and into distortion (when the physical representation of the numbers on a graph is not directly proportionate to the underlying numbers it is meant to portray) in the construction of these graphs (for example, Steinbart, 1989; Beattie and Jones, 1992; Mather et al., 1996; Frownfelter and Fulkerson, 1998; Beattie and Jones, 1999; Beattie and Jones, 2000). More recently the research into graphs has been extended to other financial reports and more specific contexts, such as IPO prospectuses (Mather et al., 2000) and CEO changes (Godfrey et al., 2003). In general, these studies find evidence that selectivity in the choice of graphs and distortion of graphs in financial reports give a favourable impression of management's performance. Critically, all of these studies use the GDI, a measure that compares the percentage change depicted in the graph with the change in the underlying data, to quantify the incidence and magnitude of graph distortion. Beattie and Jones (1992) review the literature on the effects of graphs on users' perceptions and the cognitive implications of presenting data in a graphical format on graphical perception and argue that the existence of measurement distortion is of 'prime significance' (p.293).

Leading researchers in this area use their research results to make policy recommendations. For example, Frownfelter and Fulkerson (1998:149) recommend using the GDI to monitor graphics for distortion. Similarly, Beattie and Jones (2002) rec-

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ommend, based on experimental findings, that no measurement distortion in excess of a GDI measure of 10% should be allowed in financial graphs in annual reports,

Regulatory bodies in many countries appear to recognise the need for proper presentation of information accompanying statutory financial reports. Auditors in Australia, the UK and USA are required to review other information included with the financial reports, including their presentation, to determine that it is not materially inconsistent with the information in the financial reports (for example, in Australia AUS 212 *Other Information in Documents Containing Audited Financial Reports*). Currently, these standards do not provide operational guidance on the presentation of graphs. However, drawing on an academic research report (Beattie and Jones, 1998) a recent UK Accounting Standards Board's discussion paper (ASB, 2000:28–29) made a number of recommendations about the use and presentation of graphs in annual reports. Specifically, the issue of measurement distortion is addressed by stating that 'the sizes of the symbols (columns, bars etc) should vary in direct proportion to the numerical values they represent'. Typically, such discussion papers are a precursor to the development of accounting standards on the issue discussed.

Perhaps surprisingly, little attention has been paid to the reliability of the GDI in determining whether graphs are distorted and its accuracy in quantifying the magnitude of such distortion. Accordingly, the first aim of this paper is to investigate the robustness of the GDI as a measure of graph distortion. The second aim, in what is exploratory research, is to present an alternative measure, the Relative Graph Discrepancy index (RGD).

The remainder of the paper is structured as follows: Section 2 reviews the prior literature relating to measurement distortion of graphs. Section 3 outlines some of the problems associated with using the GDI to measure the distortion of graphs while Section 4 identifies characteristics of potential alternative measures and evaluates one such measure. In Section 5 we test this alternative measure on data presented in earlier research and the results are compared to those obtained using the GDI. Section 6 contains conclusions and suggestions for further research.

2. Previous literature

2.1. The GDI

The GDI is commonly used to both identify and quantify the measurement distortion of graphs. Tufte (1983:57) states that graphic integrity and hence fair presentation of data in graphs will follow if certain principles are employed. Tufte's first principle is as follows:

> 'The representation of numbers, as physically measured on the surface of the graphic itself, should be directly proportional to the numeric quantities represented' (p.77).

This principle was put into operation by Tufte (1983, p.57) with a measure called the 'lie factor' (LF). The LF is calculated as follows:

$$\text{Lie Factor} = \frac{\text{the size of effect shown in graph}}{\text{the size of effect in data.}}$$

Hence in the absence of any distortion, the LF would be equal to 1. Where the effect in the graph is greater than the effect in the data (overstating), the LF would be greater than one and conversely, if the effect in the graph is less than the effect in the data (understating) the LF would be less than 1. Tufte (1983:57) suggested using the natural logarithm of the LF as an easy way of identifying no distortion ($\log(LF) = 0$), overstating ($\log(LF)>0$) or understating ($\log(LF)<0$). He further stated that a lie factor larger than 1.05 or less than 0.95 represented a 'substantial distortion, far beyond minor inaccuracies in plotting..

Taylor and Anderson (1986:135) modified the LF focusing on the trend in the data to suit an accounting setting and produced the graph inconsistency coefficient. This measure has the same properties and range of values as the LF. Steinbart (1989:61) modified this further to develop the GDI which is calculated as follows:

$$\text{graph discrepancy index} = 100^* \, [(a/b)-1] \qquad (1)$$

where

a = percentage change depicted in graph
b = percentage change in data

The GDI is a percentage ranging from −100% to +∞, with a value of 0% indicating that the graph has been properly constructed.[1] Positive (negative) GDI values represent the magnitude by which the trend portrayed in the graph is exaggerated (understated). Tufte's (1983, p.57) ±0.05 margin for the lie factor was extended to the GDI with values greater than +5% or less that −5% typically used to indicate that the graph is materially distorted.

The financial graphics literature examines whether graphs have been distorted in a purposeful, non-random manner. To investigate this, it is necessary to determine the nature of the measured distortion – that is, whether the distortion is favourable or unfavourable to the firm. Whether distortion is favourable or unfavourable is a function of the nature of the variable being graphed and the direction of the trend. Four commonly graphed financial variables, referred to as key financial variables (KFVs), are sales, profits, earnings per share and dividends (see, for example, Mather et al. 1996). Given the nature of these variables, exaggerations of upward trends of KFVs and understatements of downward trends are favourable to the firm, while understatements of upward trends and exaggerations of downward trends are unfavourable to the firm.

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[1] The lower bound of −100% assumes that for understatement of trends, the maximum understatement is to remove the trend in the data completely. It is possible to prepare graphs that completely reverse the trend in the data. Such a reversal would result in GDI values greater than −100%, but would represent extreme distortion and the detection risk would be extremely high.

2.2. Empirical research into measurement distortion

In recent years, there has been considerable research into the use of graphs in financial reports. Most studies address the issue of measurement distortion and use the GDI to identify and report the incidence of measurement distortion. With the exception of a few purely descriptive studies, they also test the association between measurement distortion and various measures of corporate performance.

In the US, Steinbart (1989) investigated distortion in graphs of KFVs (identified as sales, profits and dividends) of 319 companies from the Fortune 500. Steinbart found that 'on average, graphs of the three variables exaggerated the magnitude of change by about 11%' (p.63). He also reported that, using a 10% materiality cut-off (that is, considering only graphs that were distorted by more than 10%), approximately 26% of the graphs of key financial variables in the sample were materially distorted, with exaggeration and understatement being equally prevalent.

Studies that followed Steinbart have typically expanded the definition of KFVs by adding EPS as a KFV and have followed Tufte's original recommendation using a 5% rather than 10% cut-off to identify material distortion. This research includes single country studies with broad samples drawn from the UK (Beattie and Jones, 1992), Australia (Mather et al., 1996; Beattie and Jones, 1999), as well as cross-country studies such as (US/UK: Beattie and Jones, 1997; 12 countries: Frownfelter and Fulkerson, 1998; six countries: Beattie and Jones, 2001). These studies typically report a high incidence of material distortion that ranges from 24% (Beattie and Jones, 1997) to 68% (Frownfelter and Fulkerson, 1998). Similarly, the mean measurement distortion reported ranges from –13% (Germany: Beattie and Jones, 2000) to +86% (UK: Beattie and Jones, 2000).[2]

Most of these studies also examine whether favourable distortion (overstatement of a positive trend or understatement of a negative trend) is significantly more likely than unfavourable distortion (understatement of a positive trend or overstatement of a negative trend). The researchers use a binomial test to determine whether, assuming a random 50/50 split between favourable and unfavourable, the observed proportion of favourable distortion is likely to have occurred by chance. The evidence generally supports the view that favourable distortion occurs significantly more often than expected by chance. Note, however, that no account is taken of the relative magnitude of the distortion. In other words an observation with a GDI of 5% has an equal weight in the statistical tests as an observation with a GDI of 500%.

Recently research has focused on graph distortion in specific contexts. Investigating distortion of all graphs in IPO prospectuses, Mather et al. (2000) found a considerable degree of measurement distortion (mean GDI = +55.5%). However, distortion was far lower when only KFVs were considered (mean GDI value –2.0%). Similarly, Godfrey et al. (2003), while not disclosing mean distortion, report a high incidence of material distortion of graphs of KFVs in the annual reports of Australian firms in the periods surrounding CEO changes. Unlike the earlier studies that draw samples from the general corporate population, these recent context specific studies find no significant evidence that favourable graph distortion occurs more often than is expected by chance.

This research empirically demonstrates the prevalence of graph distortion as measured by the GDI based on cut-off values such as the 5% cut-off suggested by Tufte (1983). The relevance of this research has been significantly enhanced by a recent experimental study by Beattie and Jones (2002) who find that measurement distortion (as measured by the GDI) in excess of 10% changes a user's perception of corporate performance.[3]

3. The measurement of graph discrepancy and distortion

3.1. Introduction

There are two aspects to measurement distortion. The first aspect is the magnitude of the distortion. The second is the nature (favourable or unfavourable) of the distortion, which in the case of KFVs is a function of the chosen measure of performance (for example, the trend of the variable graphed) and whether the distortion exaggerates or understates the trend.

Given the availability and ease of use of graph-ing tools contained in commonly used business software such as spreadsheet and database packages, it would seem surprising that there is any discrepancy at all between graphs and the data they represent. However, the studies discussed above indicate that substantial discrepancies do exist. Whether or not the discrepancy is purely a random measurement error on the part of the preparer of the graph can be investigated empirically.[4] If the discrepancy is small (within the range +/–5% using the GDI) and/or the nature of the distortion (favourable/unfavourable) is such that it is not significantly related to the entity's performance, it may be concluded that it is in fact a random plotting error and there is no deliberate distortion.

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[2] Note that the mean GDI is not particularly meaningful as an overall measure of distortion as, in calculating the mean GDI, negative and positive values of GDI are offset.

[3] In this instance, the GDI is simply a measure that Beattie and Jones (2002) use to quantify the visual level of distortion that appears to alter perceptions. Clearly, alternative measures may be also used to quantify the same physical level of distortion.

Any discrepancy between a time-series graph and the data it represents, has been detected by a measure such as the LF or the GDI that compares the effect shown in the graph with the effect in the data. As the number of data points in the series being graphed varies, the discrepancy has always been measured using only the first and last data points. Hence the GDI compares the change in the first and last columns of the graph with the change in the first and last data items.[5]

Typically, KFVs are graphed showing a five-year trend. While it may appear reasonable to expect graphs of sales, profit, EPS and dividends to show increases over five years, particularly when sampling the general corporate population, this may not always be the case. For example, 47% of the materially distorted graphs empirically tested in Mather et al. (1996) displayed a negative trend.[6] As previously indicated, there has also been a recent extension of the literature into examining graph distortion in very specific contexts. It is not unreasonable to expect that in some of these contexts there will be a large number of KFVs with negative trends (for example, graphs of profit in the year of CEO change).

Accordingly, when considering graphs of KFVs, it is reasonable to expect the following:

1. There is no restriction on the sign/direction of the data. Both the first and last data points can take positive or negative values and they may or may not be of the same sign.[7] Hence the vertical axis of the graph spans negative and positive values;
2. As the data are from a time-series, the horizontal axis does not have negative values;
3. The trend between the first and last columns can be positive, negative or stationary; and
4. The graphs should include the origin.

A measure used to identify and quantify distortion must be robust. It must be able to measure the discrepancy regardless of the variation in graphs such as those listed above and be well defined and consistent within the range of possible values used for the inputs. The distortion measure should be symmetrical, that is, it should result in the same value if, and only if, the distortion is the same. Hence a 10% exaggeration of a positive trend and a 10% understatement of a negative trend should result in the same value.

3.2. The development of the GDI and its problems

The LF is a simple and intuitive measure that works well as a generic measure of discrepancy in a wide range of graphical representations. However, the LF in its original form has a problem when there is no change in the data or in the graph (a=0 or b=0). The LF is not defined if there is no change in the data (denominator is zero) and any scenario where there is no change in the graph (numerator) will always result in a value of 0. While these may not be common scenarios, they are quite plausible when considering time-series data such as dividends. The logarithm of the lie factor presented by Tufte (1983) is also very useful for identifying the type of distortion (+ = exaggeration and – = understatement).

The GDI is an adaptation and subsequent modification of the LF to measure financial data. The strength of the GDI is that, like the LF, it is a measure that is relatively easy to calculate. Moreover, the sign of the GDI helps identify the type of distortion (+ = exaggeration and – = understatement). However, as a result of some of the mathematical properties of the GDI, the GDI appears to be inconsistent when used to quantify the magnitude of distortion.

Consider the formulation of the GDI:

$$GDI = [\frac{a}{b} - 1] * 100 = \left[\frac{a-b}{b}\right] * 100$$

where $a = \frac{g2 - g1}{g1}\ \%$; $b = \frac{d2 - d1}{d1}\ \%$;

g1 and g2 are the heights of the first and last column in the graph; d1 and d2 are the corresponding data values. Hence *a* and *b* are the percentage change (trend) in the data and the graph.

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[4] It is also possible that some of this measurement error may be attributable to the researchers themselves. However, the use of cut-offs and consistency in the findings of several groups of independent researchers would suggest that this is unlikely to be a significant problem.

[5] The prior financial graphics literature primarily focuses on measuring the distortion of time series column/line graphs. However, Beattie and Jones (1994) also develop measures to be used on pie-charts.

[6] This is not altogether surprising as Mather et al. (1996) sampled the 1992 annual reports of Australian firms and Australia was experiencing an economic recession during this period.

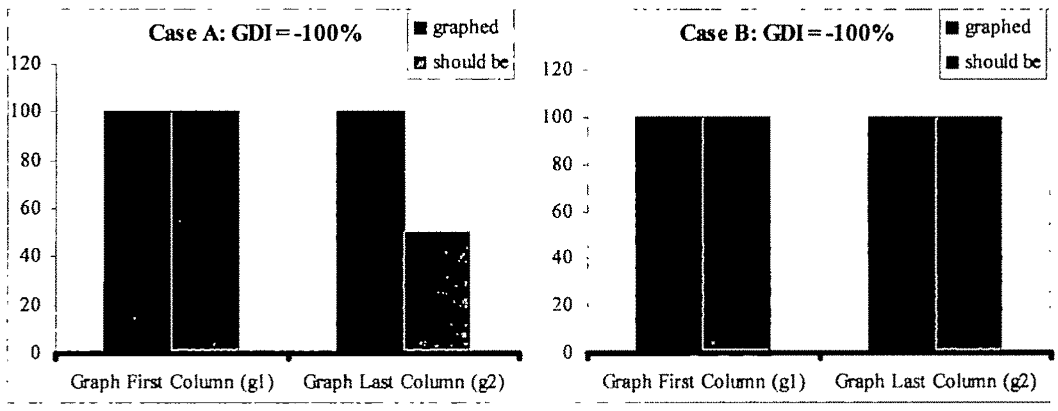
[7] While sales and dividends cannot be negative, profit and EPS can be negative.

Table 1

Graph Number	*Graph Type*	*Graph c1*	*Graph c2*	*Data d1*	*Data d2*	*Fav / Unfav*	*a*	*b*	*GDI*
33	Dividend	0.6	0.6	21	20	fav	0.0%	–4.8%	–100%
39	Profit	2.2	2.2	421.2	423.2	unfav	0.0%	0.5%	–100%
76	Dividend	1.8	1.8	9.1	9	fav	0.0%	–1.1%	–100%
155	Turnover	2.2	2.2	3669	3624	fav	0.0%	–1.2%	–100%

Exhibit 1

Case	*Graph First column g1 (cms)*	*Graph Last column g2 (cms)*	*Data First column d1 (units)*	*Data Last column d2 (units)*	*% change in graph (a)*	*% change in data (b)*	*GDI*
A	10	10	100	50	0%	–50%	–100.0%
B	10	10	100	99.9	0%	–0.1%	–100.0%



We now explain and illustrate the problems arising from the use of the GDI.[8]

3.2.1. Inconsistency

A measure is defined in the Macquarie dictionary as 'a basis or standard for comparison'. In order to enable this comparison to be made, a measure must produce consistent results across all the cases that are being compared. As an example, when a ruler is used to measure the length of two objects, if the resulting values are identical, it is naturally implied that the two lengths are the same and placing the two objects side-by-side can verify this. Further, one would expect that if measurement by the ruler determines one object to be longer than another, then this would in fact, be the case. When using the GDI to measure distortion, many instances exist where the calculated GDI value is the same, but the actual distortion evident visually is quite different. Similarly, a graph with a high GDI value may show much less distortion that one having a lower GDI value (or vice-versa). We show that the GDI is not consistent as a measure and cannot be used as a basis for comparison. Hence, if you use the GDI to calculate graph discrepancy in a collection of graphs, the results obtained and inferences made will not be accurate.

The scenarios presented below illustrate in-

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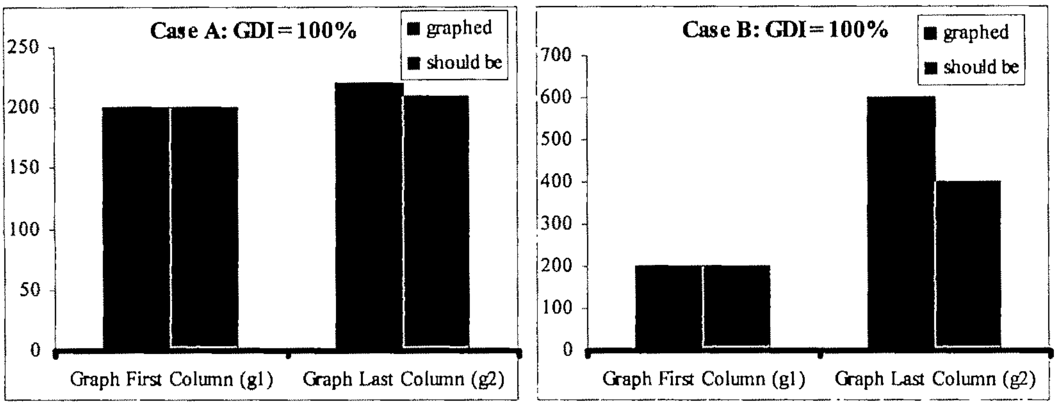
[8] Based on the mathematical properties of the GDI, the following problems arise:

a) The GDI is a fraction with a denominator, *b*, which will be zero whenever the trend in the data is zero resulting in a discontinuity (singularity) in the function. Hence irrespective of the value of *a* (and hence the level of distortion), the GDI will be undefined in these instances.
b) Irrespective of the level of distortion, if the trend in the graph is zero, the GDI will take the value of –100%.
c) The GDI measures the difference between the trend shown in the graph and the trend in the data as a *percentage*. Hence, even a negligible change to a small trend in the data can result in a high GDI values. As the trend is already measuring a change, the change in the trend measures a second degree of change. The use of trends as parameters and the calculation of changes to trends will result in such inconsistencies.

Exhibit 2

Case	*Graph First column g1 (cms)*	*Graph Last column g2 (cms)*	*Data First column d1 (units)*	*Data Last column d2 (units)*	*% change in graph (a)*	*% change in data (b)*	*GDI*
A	5	5.5	200	210	10%	5%	100.0%
B	5	15	200	400	200%	100%	100.0%



stances of inconsistency using a data set from Mather et al. (1996) ('the data set')[9] as well as some hypothetical examples.[10]

The case of the GDI being –100%:

When the change between the first and last columns in the graph (*a*) is zero, regardless of the level of distortion, the GDI takes the value of –100% . There were four instances (out of 128 materially distorted graphs) of GDI values of –100% in the data set (graph numbers 33, 39, 76 and 155). An examination of Table 1 (p.151) indicates that the distortion in every one of these graphs was negligible and they should not have been counted in the set of materially distorted graphs. Using the GDI they have been counted as four (three of them favourable) cases of extreme distortion. Although it is not clear whether previous studies have screened out such cases where no change in the graph resulted in extreme GDI values, it is clear is that the GDI cannot be relied upon to be consistent. These cases are shown in Table 1.

A GDI of –100% is also obtained when the graph has been plotted to completely remove the trend in the data. The table and graphs in Exhibit 1 further illustrate this inconsistency. In case A, the graph has been plotted to completely remove the downward trend in the data and is significantly distorted, while case B has almost no distortion and yet, both have a GDI value of –100%.

The sensitivity to the changes in the trend:

As the GDI calculates the distortion relative to the percentage change in the data, it is based on changes in the trend. Hence, as shown in Case A in Exhibit 2, if the change in the data (*b*) is small, even a minor discrepancy in the trend shown in the graph (*a*) can result in a high GDI value.[11] On the other hand, in Case B a moderate change in a large trend can result in an identical GDI value. The two cases are illustrated in Exhibit 2 to demonstrate this inconsistency. Both graphs result in a GDI value of 100% yet there is a marked difference in the visual distortion.

This inconsistency is also illustrated in the two cases from the data set (graph numbers 240 and 211) shown in Exhibit 3. As evident from the graph there is a marked discrepancy in case B (graph 211) whereas, even though the GDI calculated for case A (graph 240) is higher, there is hardly any distortion visually present in the graph.

We found at least 11 instances where the GDI calculated was not consistent (when compared with graphs with similar GDI values) in the data set of 128 materially distorted graphs. It is imprac-

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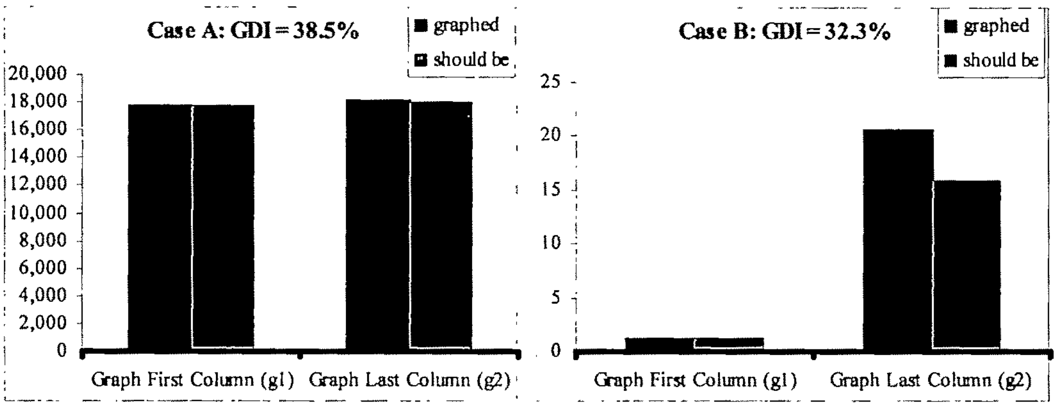
[9] See Section 5.1 of the paper for details of the data set.

[10] Please note that the heights of columns given in tables are the actual heights measured in the annual report in question rather than the graphs shown in this paper. The graphs shown in this paper have been scaled (without losing any proportions) to fit the paper.

[11] Deletion of extreme positive outliers is an approach sometimes used in the prior literature to mitigate measurement problems with the GDI caused by small discrepancies (Beattie and Jones, 1997:53). We contend that a better approach is to adopt a more consistent and reliable measure of distortion that would reduce, if not eliminate, the need for such action.

Exhibit 3

Case	Graph	Graph First column g1 (cms)	Graph Last column g2 (cms)	Data First column d1 (units)	Data Last column d2 (units)	% change in graph (a)	% change in data (b)	GDI
A	240	3.7	3.8	17,729	18,075	2.7%	2%	38.5%
B	211	0.2	3.3	1.25	15.9	1550%	1172%	32.3%



tical to identify how many more instances of such inconsistencies are present in the data set without an extensive reexamination and comparison of every single graph.

3.2.2. Discontinuity/Not being able to calculate the GDI

Being a ratio, the GDI is undefined if the denominator, $b = 0$. Hence, it is not possible to calculate the GDI if the first and last data points are the same (stationary trend between first and last data points) as can happen with graphs of dividends. As shown in Exhibit 4, the first and last data points being the same magnitude (stationary) has no implication on the level of distortion. There were three cases of such discontinuity in the data set of graphs presented in Section 5 of this paper.

In sum, we found at least 18 graphs in the data set of 128 materially distorted graphs that demonstrated problems with the GDI. As indicated earlier, we stress that it is impractical to identify all cases of inconsistency without examining and comparing every graph in the data set.

4. The search for alternative measures

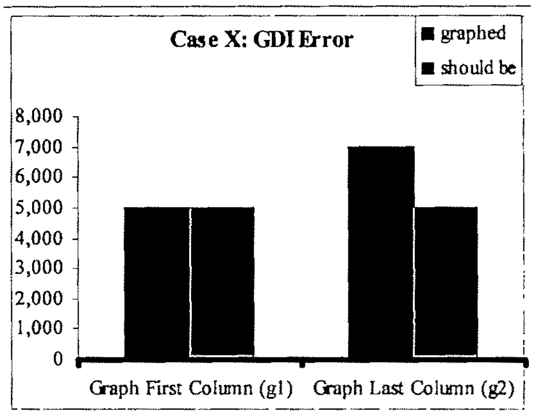
The problems identified above are largely brought about by the mathematical properties of the GDI and the parameters used (percentage trend) to calculate it. In general, mathematical expressions in the form of a fraction are not very robust and the focus on a parameter such as the trend results in high sensitivity to small changes in the data. Hence, we looked for other ways to capture and measure the visual discrepancy.

This search took us back to Tufte's original work on preserving graphical integrity (Tufte, 1983) where he introduced the most intuitive and generic of measures, the lie factor. This led us to look again at physical measurements on the surface of the graph that could be used to measure the 'effect shown in the graph' so that they can be compared to the 'effect shown in the data'. We focused on the height of the column of data in question thus finding ways to measure the difference between the height of the column as it is graphed and the height it should be had the graph been plotted accurately. Apart from measuring the visible discrepancy, one of the other advantages of using heights rather than changes in the data (trend), is that a height is measured directly from the graph and the case when the height is zero (represents a data value of zero) is self evident (unlike a trend of zero between the first and last data points).

In order to investigate the merits of proposed new measures and compare these with the GDI, we developed a graphical simulation tool on MS Excel. This decision support tool enabled us to simulate a large number of scenarios of graphs with varying types and magnitudes of distortion and compare the resulting values generated by each measure. This tool included a 'distortion tester' that enabled us to view graphs of each of the simulated scenarios along with the distortion (the graphs presented in the previous section were created using this tool).

Exhibit 4

Case	*Graph First column g1 (cms)*	*Graph Last column g2 (cms)*	*Data First column d1 (units)*	*Data Last column d2 (units)*	*% change in graph (a)*	*% change in data (b)*	*GDI*
X	5	7	5000	5000	40%	0%	#DIV/0! (division by zero)



4.1. *Characteristics of alternative measures*

Having recognised the problems associated with the GDI, we identify properties that an alternative measure needs to have as well as properties that are desirable in such a measure. Rather than attempting to find the *best* measure, we concentrate on presenting a measure that is consistent and robust for the purpose of identifying as well as measuring graph distortion in financial reports.

The properties we identify as necessary are:

1. The formula must use parameters that can be obtained from the data and physical measurements on the surface of the graph and must be applicable to all types of column graphs (positive/negative values as well as positive/negative trends). The resulting value should identify and measure any discrepancy between the graph and the data it represents;
2. The calculated values must be consistent (that is, similar levels of visual distortion should result in similar values for the measured distortion and the calculated value must correspond to the level of discrepancy that is visible); and
3. The measure must be applicable across the expected range of input values (that is, not having points at which the measure cannot be calculated).

The properties we identify as being desirable, but not necessary, are:

1. Being easy to calculate;
2. Being able to identify the nature/type of distortion;
3. Being discernible/discriminating (that is, to clearly separate different levels of distortion);
4. Being proportional to the level of distortion;
5. Being intuitive (that is, to easily understand what the function is measuring); and
6. Being generic enough to be able to be used on graphs other than bar charts and incorporate more data points (rather than just first and last).

4.2. *The Relative Graph Discrepancy (RGD)*

We present a measure that is a function of the height of the last column as it is plotted and the height at which it should have been plotted.[12]

The parameters used in this measure are as follows:

$d1$ = value of first data point (corresponding to first column);
$d2$ = value of last data point (corresponding to last column)
$g1$ = height of first column (graph);
$g2$ = height of last column (graph);
$g3$ = the correct height of last column (if plotted accurately). Hence

$$g3 = \frac{g1}{d1} x d2 .$$

Note that if the data are negative, the correspon-

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[12] We also developed two other measures: the Log Discrepancy Index = $\mathrm{Log}(\frac{g2}{g3})$ and the Height of Discrepancy = $g2-g3$. These are not discussed in this paper. Clearly, other measures are possible. We commend the search for the 'best' measure to future research.

Table 2
Problem scenarios: comparison of GDI and RGD

Graph No / Case	*Scenario*	*Graph First column g1 (cms)*	*Graph Last column g2 (cms)*	*Data First column d1 (units)*	*Data Last column d2 (units)*	*% change in graph (a)*	*% change in data (b)*	*GDI*	*RGD*
33	No trend in graph	0.6	0.6	21	20	0%	–4.8%	–100%	5%
39	No trend in graph	2.2	2.2	421.2	423.2	0%	0.5%	–100%	0.5%
76	No trend in graph	1.8	1.8	9.1	9	0%	–1.1%	–100%	1.1%
155	No trend in graph	2.2	2.2	3669	3624	0%	–1.2%	–100%	1.2%
Exhibit 1, Case A	Complete removal of trend	10	10	100	50	0%	–50%	–100%	100%
Exhibit 1, Case B	Inconsistent with 1	10	10	100	99.9	0%	–0.1%	–100%	0.10%
Exhibit 2, Case A	Sensitivity to trend	5	5.5	200	210	10%	5%	100%	4.7%
Exhibit 2, Case B	Inconsistent with A	5	15	200	400	200%	100%	100%	50%
Exhibit 3, 240	Sensitivity to small changes	3.7	3.8	17729	18075	2.7%	2%	38.5%	0.7%
Exhibit 3, 211	Similar GDI to 1 above (inconsistent)	0.2	3.3	1.25	15.9	1550%	1172%	32.3%	29.7%
Exhibit 4, Case X	Cannot calculate GDI (discontinuity)	5	7	5000	5000	40%	0%	#DIV/0! (division by zero)	40%

ding height is negative (as plotted in a graph).

The formula for the RGD is as follows:

$$\frac{g2 - g3}{g3}$$

The RGD is a comparative measure, using the first data point and the height of the first column on the graph to determine the height the last column on the graph should be. An example of the calculation of the RGD is given below:

Assuming a case of a graph where:

$d1$ = the value of first data point is \$100;
$d2$ = value of last data point is \$200;
$g1$ = height of first column (graph) is 10cm;
$g2$ = height of last column (graph) is 25cm;

Then $g3$ = the correct height of last column

$$g3 = \frac{g1}{d1} \times d2$$

is 10/100 x 200 = 20 and the RGD = (25 – 20)/ 20 = 25%

We now illustrate the use of the RGD and its better performance compared to the GDI without making any claims that it is the 'best'. The RGD looks similar to the GDI and is both intuitive and easy to interpret. While the LF and GDI measure the percentage change in the graph relative to the percentage change in the data, the RGD measures the height of the last column as it is graphed ($g2$) relative to the height at which it should have been graphed ($g3$) and this is given as a percentage.

The RGD satisfies our list of necessary properties. It is consistent within the range of expected input values and it is linear. Given that it is measuring the height of a column, the issue of sensitivity to small changes in large data does not arise; however small or large the data, the graph (and hence the heights) will be scaled to represent the data. The only case where the RGD cannot be calculated (discontinuity in the function) is when the last data point is zero; i.e. if g3 = 0, a rare occurrence (there were no such cases in our data set). This exception is easily identified, as it is much

Table 3
Favourable and unfavourable distortion using the RGD and GDI

Last column	*Nature of distortion to* ***height***	*Type of distortion*	*RGD*
> 0	Exag	**fav**	**> 0**
< 0	under	**fav**	**> 0**
> 0	under	unfav	< 0
< 0	Exag	unfav	< 0

Trend in data	*Nature of distortion to* ***trend***	*Type of Distortion*	*GDI*
(+) ve	**exag**	fav	**> 0**
(–) ve	**exag**	unfav	**> 0**
(+) ve	under	unfav	< 0
(–) ve	under	fav	< 0

easier to identify a zero data point than a stationary trend (which causes a similar problem with the GDI). This scenario is also unlikely to be conducive to any significant distortion. If there is a measurable discrepancy (visible column representing the last data point), the corresponding RGD value could be set to 100% as this would be a serious case of distortion.

The RGD overcomes all the problem scenarios presented in Section 3 where the values generated for the GDI were unrepresentative. Table 2 (p.155) shows the corresponding values of the new measure in each of the cases.

Considering the properties that were identified as desirable, all of these are satisfied by the RGD. The RGD requires the same graph measurements as the GDI and is easier to calculate. A positive (negative) RGD results from exaggerating (understating). In graphs of KFV's (where an increasing trend is generally desirable) the RGD can be used to identify the nature of distortion based on whether the corresponding data point is positive or negative. If the data is positive, a positive value of the RGD indicates favourable distortion. The result is reversed in the more uncommon instances where the last column is negative. Unlike the GDI, the trend of the data is not required to identify the nature of the distortion. Table 3 summarises these cases.

The RGD has similar discriminating power to the GDI in that the RGD clearly separates levels of distortion. In relation to the measure being linear and proportional to the level of distortion, the RGD is superior to the GDI. The RGD is a consistent measure and is proportional to the level of distortion, whereas the GDI gives the impression of being proportional to the level of distortion, but due to the inconsistencies documented earlier, the GDI is not truly proportional (for example, a GDI of –100% might reflect significant distortion via removal of the trend in the data, or it might result from their being no trend in the graph).

The extent to which these measures are intuitive is a matter for debate. However, we argue that in the absence of prior familiarity with the GDI, the RGD is more intuitive than the GDI. In general, the comparison of heights is a lot more intuitive than comparison of trends, as a height is what is visually evident whereas a trend must be interpreted using the heights. The RGD is also generic enough to be adapted to measure distortion in graphs such as pie charts by using the angle or area of the wedge. The RGD can also be extended to include points in-between the first and last data points and thus measuring an average (or maximum) distortion.

5. Testing the RGD on data presented in earlier research

5.1. Data

A data set previously presented in Mather et al. (1996) was used to test the efficacy of the RGD and compare results with those obtained using the GDI. The original sample examined the 1992 annual reports of the top 150 Australian Stock Exchange listed companies by market capitalisation as at December 1992 In the earlier study, seven companies were eliminated from the sample because their 1992 and/or 1991 annual report(s) could not be obtained. For the purposes of this testing, a further company had to be eliminated as we could not locate the original research instrument documenting the information needed for empirical testing. Accordingly, the partial replication was carried out on a sample of 142 companies. There were a total of 236 KFV graphs and following the prior literature 128 of these graphs could be considered materially distorted (GDI with values greater than +5% or less that –5%). A sizeable number of these distorted graphs portrayed a

Table 4
Descriptive statistics

	GDI	*RGD*
Mean	23.6% (absolute mean = 38%)	11.1% (absolute mean = 16%)
Standard Error	9.4%	4.4%
Median	0.0%	0.1%
Standard Deviation	144.0%	67.6%
Minimum	–100.0%	–62.9%
Maximum	1161.1%	771.8%

Table 5
Correlation between the GDI and the RGD

GDI and RGD	*Spearman r_s*
Positive GDIs	0.65
Negative GDIs	0.41

downward trend (60/128) and/or were understated, that is, had negative GDI values (41/128).[13]

5.2. Descriptive statistics and correlation between the GDI and RGD

Table 4 sets out some of the descriptive statistics of the GDIs and RGDs calculated for the graphs in the above data set.

As Table 4 shows, the mean and absolute mean of the RGD are lower than those of the GDI. Additionally, both the standard error and the standard deviation show that the RGD values are far less dispersed in comparison to the corresponding GDI values.

Most of the consistency problems with the GDI are associated with the negative scale. Hence, as can be seen in Table 5, when analysing the results generated by the two measures in the data set, where there is an exaggeration/a positive GDI there is a higher correlation between the GDI and the RGD (Spearman rank correlation coefficient r_s = 0.65). Conversely there is lower correlation between the GDI and the RGD in the cases where there is an understatement/a negative GDI (Spearman r_s =0.41).[14]

5.3. Comparison of types of distortion

A central issue in most prior studies has been to investigate whether the incidence of favourable distortion is significantly more likely than unfavourable distortion. As discussed earlier, using the GDI, the effect of graphical distortion is described as favourable if an improving performance is exaggerated or if a declining performance is understated. The effect is classed as unfavourable in opposite circumstances. In Table 6 (overleaf) we analyse the data set to categorise graph distortion as favourable or unfavourable. A binomial test is then used to determine whether, assuming a random 50/50 split between favourable and unfavourable, the observed proportion of favourable distortion is likely to have occurred by chance. Following Mather et al. (1996), we also subdivide the graphs into those in the annual reports of the top 50 companies (by market capitalisation) and those of the next 100 companies.

In order to follow prior studies that use a ±5% cut-off (introduced for the lie factor by Tufte, 1983) we attempted to estimate the approximate equivalent threshold by calculating the RGD values equivalent to a GDI of +5%. However, given the inconsistency demonstrated by cases A and B in Section 3, there were many different scenarios that led to a GDI of 5% each with a different RGD value. Hence, we decided to make use of the strong correlation between the GDI and RGD when the GDI was positive to estimate the equivalent RGD cut-off. The slope coefficient from a regression analysis between the GDI (for positive values only) and the RGD was found to be approximately 0.5. Hence, the equivalent RGD for a 5% GDI was taken as 2.5%.[15]

While the table may give the impression that the incidence of distortion as identified using the GDI

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[13] As noted in footnote 6, the early 1990s was a period of economic recession in Australia, thus contributing to the large number of downward trending graphs. Mather et al. (1996), note that the frequency of graph usage in the sample and the breakdown of KFV graphs found were similar to previous studies (p. 59).

[14] However, given that some of the matched pairs of GDI and RGD values are of opposite signs and the issue of the negative GDI values being compressed, this result has to be interpreted with caution. The corresponding Pearson r for the positive GDIs is 0.93 and is 0.34 for the negative GDIs.

[15] Finding appropriate cut-offs is not the focus of this paper. The cut-off value for the RGD and other alternative measures need to be researched further.

Table 6
Types of graph distortion

Number of graphs of key financial variables		*GDI (5% cut-off)*	*RGD (2.5% cut-off)*
All companies	total	128	104
	fav	75	65
		(p=0.05)	(p=0.008)
	unfav	53	39
Top 50 companies	total	57	38
	fav	29	20
		(p=0.89)	(p=0.74)
	unfav	28	18
Next 100 companies	total	71	66
	fav	46	45
		(p=0.01)	(p=0.003)
	unfav	25	21

were similar to those identified using the new measures, in reality this was largely coincidental. There were a number of observations where the GDI and the new measures gave substantially different outcomes. For example, there were 34 graphs classified as being materially distorted using the GDI that were not classified as being materially distorted using the RGD (18 favourable and 16 unfavourable). Similarly, there were 10 graphs classified as being materially distorted using the RGD that were not so classified using the GDI (nine favourable and one unfavourable).

6. Conclusions

The graph discrepancy index (GDI), which originates from Tufte's lie factor (1983), is the measure commonly used in the financial graphics literature to determine whether graphs are distorted and to quantify the extent of such distortion. This paper focuses on the measurement of distortion in graphs and is motivated by the fact that, while the GDI is critical to the aforementioned financial graphics literature, little or no attention has been paid to its robustness and accuracy in determining graph distortion and its reliability in quantifying the magnitude of such distortion. More specifically, we examine the attributes of graphs that facilitate distortion, the mathematical characteristics of the GDI, the parameters used in the formula and show that it is inconsistent as a measure of graph distortion.

We have demonstrated that the GDI is inconsistent and presented numerous examples from a data set to show that these problems are not purely theoretical. A high (low) GDI value is not necessarily associated with high (low) visual distortion in the graph. This is a particular problem when using any cut off to identify graphs that are materially distorted as differing levels of distortion can result in the same GDI. Additionally, as a result of the above-mentioned inconsistencies, the GDI is also not proportional across the range of expected scenarios. More generally and as a consequence of this, we show that in numerous instances the GDI values calculated are not particularly meaningful and that it is not appropriate to use the GDI to identify materially distorted graphs.

Using a normative analysis, we identify necessary as well as desirable properties a measure of graph distortion should have. In exploratory research, we present an alternative measure of graph distortion that focuses on the discrepancy in the height of the last column. This is intended to start a research process that leads to a generally accepted measure. The Relative Graph Discrepancy index (RGD), is used to demonstrate that it is possible to overcome the problems associated with the GDI. We identify one instance where the RGD cannot be calculated but this is easy to identify and a solution is suggested. The RGD was also tested on data presented in earlier research and the results are compared to those obtained using the GDI. Overall, in comparison with the GDI, the RGD is a robust measure and produces slightly stronger results.

This research has several implications. First, the work suggests that researchers need to be aware of the problems associated with using the GDI as the measure of graph distortion and make an informed choice about the research tools they use. As indicated earlier, many of the problems with the GDI are associated with the negative scale (where there is understatement). Accordingly, we recommend that researchers who wish to continue to use the GDI should exercise particular caution when the data suggests the prevalence of a non-trivial number of understated graphs. Additionally, they should screen their data to identify instances of the problem scenarios outlined earlier. Second, regulation should not be couched in terms of the GDI as advocated by some academic researchers (e.g. Frownfelter and Fulkerson, 1998:149) or any other current measure but should be expressed in terms of operational guidelines such as contained in CICA (1993:147–155).

Finally, there is a clear need for further research. More specifically, further research into measures such as the RGD as well as other measures is necessary to find a 'best' or generally accepted measure. Research is also needed on appropriate cut-offs for determining significant distortion when using these alternative measures. Additionally, the empirical research to date focuses on the incidence of distorted graphs rather than the magnitude of such distortion. Further research is needed to determine whether these new measures can be used to evaluate the magnitude of distortion using conventional parametric tests. This will enable researchers to answer research questions such as 'is the mean distortion of graphs that are favourably distorted significantly greater than the mean distortion of graphs that are unfavourably distorted?'

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Why do executives serve as non-executives? Pre-Cadbury evidence from UK non-financial companies

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Abstract—This paper examines the extent to which executives in the largest UK non-financial companies served as non-executives in other companies prior to the governance reforms of the mid-1990s. The paper also seeks to identify factors that affected the holding of additional directorships by executives. The results reported here suggest that possession of non-executive directorships by executives was not widespread. The average number of additional directorships held by each executive was 0.15 with CEOs being the principal holder of such positions possessing an average of 0.33. Indeed, 89.5% of executives (76.4% of CEOs) held no additional directorships. The holding of additional directorships was positively related to the level of non-executive representation on the board of the executive's company, executive tenure and company size but negatively related to executive ownership. The presence of CEO duality had a positive impact on the holding of additional directorships by CEOs.

1. Introduction

The objective of this paper is to provide empirical evidence on the incidence of executives as non-executive directors in other listed companies. The paper examines the influence of a number of factors on both the likelihood that an executive holds an additional directorship as well as the number of directorships held. Even though the use of executive directors as non-executives has received relatively little prior attention, the few studies that have been undertaken provide useful insights on the issue. One of the surprising findings of previous work is the low incidence of executive directors serving as non-executives elsewhere. For example, Booth and Deli (1996) reported that the mean number of outside directorships held by CEOs in a sample of 440 large US companies in 1989 was 1.87. Booth and Deli (1996) also reported that the principal holder of additional directorships is the company's CEO. Using 1995 data on 3,190 US firms, Ferris et al (2003) report that only 15.6% of all directors hold more than one directorship. In an analysis of non-executive directorships held by UK directors in 1996, Peasnell et al. (1999) reported that only 7.2% of executives held non-executive directorships in other companies.

This study seeks to add to the existing literature in a number of respects. First, a UK-based study provides a useful source of comparison with the findings of existing work in the US. Second, existing studies have focused on the non-executive role of CEOs while this study includes all executives, thereby providing a more comprehensive perspective on the holding of non-executive directorships by all executive directors. This is especially relevant in the UK where executives represent a significant proportion of board members. Finally, an important aspect of this study relates to its timing. In the wake of the *Report of the Committee on the Financial Aspects of Corporate Governance* (Cadbury, 1992), the past decade has witnessed significant changes in the way boards in the UK are comprised and led. This paper utilises data prior to the widespread adoption of the Cadbury (1992) recommendations and consequently provides a useful insight on the holding of non-executive directorships by executives prior to the increased emphasis on non-executive monitoring following the publication of Cadbury (1992) and subsequent governance reports. The analysis presented in this paper includes 500 of the largest non-financial companies in the UK at the end of 1991, containing 2,564 executive directors.

The empirical results suggest that possession of additional directorships by executives was not widespread. The average number of additional directorships held by each executive was 0.15 with CEOs being the principal holder of such positions possessing an average of 0.33. Indeed, 89.5% of executives (76.4% of CEOs) held no additional directorships. Executives in companies with stronger board monitoring, represented by a higher proportion of non-executive directors, were more likely to

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possess additional directorships. The holding of additional directorships was also more likely in larger companies and the longer an executive had served on the board. CEO duality had a positive impact on the holding of additional directorships by CEOs. Managerial ownership had a negative impact on the holding of additional directorships. When the sample is portioned between CEOs and non-CEOs, CEO ownership is found to have a negative impact on non-CEOs' holding of directorships.

The paper proceeds as follows: the next section examines factors likely to influence executives' decisions to serve as non-executives in other companies. Section 3 introduces the variables and describes the data. The empirical results are presented and discussed in Section 4. Details of sensitivity tests are outlined in Section 5 while conclusions and limitations of the study are discussed in Section 6.

2. Why do executives hold non-executive directorships?

Bacon and Brown (1974) identify a number of ways in which the possession of additional directorships is capable of improving the quality of an executive's management of his/her own company: (1) additional directorships provide an opportunity to compare management policy and practices with the executive's own company; (2) an executive can learn how other companies pursue new approaches to business that may be relevant to his/her company; (3) certain additional directorships expose an executive to trends in interest rates, input factor prices or aspects of international business which may be relevant to the executive's own business; (4) monitoring the behaviour of different teams exposes an executive to different management styles which may be adopted and applied to the executive's company; and (5) additional directorships provide an important source of advice should an executive subsequently require the opinion of other senior executives.

Unseem (1984) suggests that executives who sit on other boards benefit from what he terms 'business scan' and provides some support for this in the following comment from one of the executives he interviewed:

> 'It extends the range of your network and acquaintances, and your experience. That's why you go on a board, to get something as well as to give...It just broadens your experience, the memory bank that you have to test things against.' (pp. 47–48)

Ward (1998) provides further support for the notion that holding additional directorships is perceived to benefit the executive's company. Ward (1998) reports that 83% of questionnaire respondents believed their company benefited from executives holding non-executive directorships. Regarding the source of such benefits, 55% of respondents mentioned the opportunity for their executives to gain 'wider experience' and 'personal development' while 12% mentioned the opportunity for executives to improve 'business contacts' and obtain 'new ideas' (p.89).

Holding additional directorships however, may also be a way in which executives pursue their own objectives at shareholders' expense. As Mace (1986) observes, holding additional directorships is likely to be a form of prestige for executives. For example, if status within the business community is important to executives, we would expect such executives to accept more additional directorships than their shareholders consider optimal. In a US study, Davis (1993) reports that the number of boards to which new directors were appointed during the 1980s depended largely on the number of other boards of which they were already members and the network interlock of boards on which they already held directorships. Furthermore, Booth and Deli (1996) find that CEOs who are also chairmen hold more additional directorships and the number of additional directorships held by CEOs is positively related to the company's director interlocks with other boards. In addition to being a symptom of managerial interests overriding the interests of shareholders, executives may also seek to utilise their association with other companies to benefit themselves more directly. Hallock (1997), for example, examines the relationship between the existence of reciprocal interlocks and CEO compensation. Hallock (1997) finds that CEOs with interlocking boards get paid more than otherwise similar CEOs. In a subsequent study, Core et al. (1999) also find that interlocked CEOs receive higher remuneration.

Viewing the holding of additional directorships as essentially a tension between strong and weak governance highlights the agency characteristics of the issue since, depending on the particular set of circumstances, the holding of additional directorships by executives may be either consistent or inconsistent with shareholder objectives. The modern theory of the firm suggests that competition and economic selection ensures an efficient utilisation of resources (Fama and Jensen, 1983a and 1983b). In order to survive in a competitive market, companies need to utilise their resources efficiently. In the context of the resource under discussion in this study (i.e. senior executives), economic competition suggests that companies observed in the market are those in which senior executives are used most efficiently. If the possession of non-executive directorships in other companies represents value-increasing projects for executives' companies, it is important to identify the sources of such value.

Even though the primary focus of this paper is to examine factors that impact the supply of executives to serve as non-executives, in order to understand the overall operation of the market for executives it is also necessary to consider the impact of demand factors since the possession of additional directorships only arises when an executive is offered a board seat by another company. The remainder of this section explores factors likely to influence the holding of non-executive directorships by executives.

2.1. Board composition and leadership

Separation of the functions of ownership and management, which characterises large public companies, facilitates the potential for executives to administer the company in their own interests at the expense of shareholders (Berle and Means, 1932). A central objective of corporate governance is to ensure that executives pursue shareholder objectives in their administration of the company. If the holding of non-executive directorships by executives is beneficial for companies, as suggested by the findings of Ward's study, we would expect executives pursuing shareholder objectives to hold additional directorships (subject to the kind of restrictions identified in Ward's (1998) survey). Shareholder wealth is maximised by executives accepting non-executive directorships until the marginal benefits to the executive's company equal the marginal costs.

An important focus of governance attention is the composition and leadership of the board of directors. In particular, concern has been expressed that companies with low levels of non-executive representation and CEO duality may not operate in the best interests of shareholders (Cadbury, 1992; Hampel, 1998). The weakened monitoring that is expected to result from low levels of non-executive representation is likely to result in executives possessing more additional directorships than shareholders consider optimal as they pursue their own interests rather than seeking to maximise shareholder wealth. The presence of CEO duality also suggests that such individuals are more likely to be in a position to pursue their own interests at shareholders' expense. Consequently, the decisions of CEOs who are also chairmen to accept offers of non-executive directorships are less likely to be influenced by the interests of their shareholders. When companies have strong non-executive board representation and a separate CEO and chairman, we would expect such companies to encourage their executives to hold additional directorships since the holding of such appointments are expected to be in shareholders' interests. Therefore, from the supply-side perspective, both strong board governance and weak board governance are expected to result in executives possessing additional directorships. Precisely which of these competing effects dominates in practice is an empirical issue on which this study seeks to shed light.

Since an executive cannot hold an additional directorship unless his services are required by other companies, the impact of board governance on the demand for executives to serve as non-executives also needs to be considered. If CEO duality and low non-executive representation are perceived as signals of weak board governance, it is expected that executives from such companies will receive fewer offers of non-executive positions since such executives are less likely to be viewed as good monitors. On the other hand, executives from companies perceived as being well governed are more likely to be in demand as other companies pursue good governance for their own boards. The net effect of this demand for executives from well-governed companies is expected to outweigh the self-serving willingness of executives from weaker governed boards to accept the offer of additional directorships. Consequently, we would expect CEO duality and low levels of non-executive representation to be negatively associated with the holding of additional directorships.

2.2. Managerial ownership

Even though the separation of ownership and control is expected to make external shareholder monitoring difficult and costly, shareholder and executive objectives may be reconciled when managers hold an equity stake in their company. Jensen and Meckling (1976) suggest that an increase in the proportion of equity owned by managers is likely to result in an increase in shareholder value through improved alignment of manager and shareholder interests. The available empirical evidence reveals a more complex relationship between managerial ownership and managerial behaviour than that posited by Jensen and Meckling (1976). In particular, a number of studies identify the possibility that while managerial ownership appears to align the interests of shareholders and mangers at both low and high levels of ownership, intermediate levels of ownership may be associated with entrenchment behaviour on the part of owner-managers. In particular, Morck et al. (1988) find evidence of value-maximisation at ownership levels below 5% and greater than 25% but find evidence of entrenchment in the 5–25% range. Utilising UK data, Short and Keasey (1999) also report a non-linear relationship between managerial ownership and performance. However, they find that performance is positively related to managerial ownership at ownership levels between 0 and 12% and in excess of 42%, with entrenchment occurring between the 12 to 42% range.

We would expect managerial ownership to influence executives' willingness to serve on other company boards. While good governance considerations suggest a negative association between executive ownership and the holding of additional directorships, the possibility of entrenchment at certain levels of managerial ownership complicates the picture. The empirical studies cited earlier suggest that executives on boards with either low or very high levels of ownership are expected to hold fewer additional directorships as they focus on maximising shareholder value in their own companies. On the other hand, where board ownership lies at intermediate levels, executives are more likely to pursue entrenchment and one aspect of this is likely to be the holding of non-executive directorships. Of course, when demand-side considerations are considered, it is likely that other companies will be reluctant to offer non-executive directorships to executives perceived to be exhibiting entrenchment behaviour and are more likely to seek value-maximising executives. In the case of managerial ownership therefore, supply and demand-side considerations suggest that executives from companies with low and very high levels of executive ownership are more likely to be offered additional directorships but are less likely to accept them. Executives from companies with intermediate ownership levels are less likely to be offered additional directorships but are more likely to accept any offers made. An important objective of this study is to provide some empirical insights on how managerial ownership influences the holding of additional directorships in practice.

2.3. Barter system for non-executives

Lorsch and MacIver (1989) argue that executives may accept outside directorships in order to attract other executives to serve as non-executives on their boards, suggesting the operation of a type of barter system in non-executive directorships. Executives serving as non-executives elsewhere allow a company to 'purchase' the services of other executives as non-executives. Viewing the market for non-executive directors in this way suggests that executives may be more willing to serve as non-executives if the cohort of non-executives on the executive's own board contains an executive from another company. Booth and Deli (1996) test for this relationship but fail to find evidence of a link between the number of additional directorships held by CEOs and the number of executives from other companies serving as non-executives on the CEO's own board.

2.4. Performance

An important factor in the holding of additional directorships by executives is likely to be their performance as executives in their own companies. From a supply-side perspective, it can be argued that executives from high and low performing companies are likely to possess fewer outside directorships since better performing companies will be anxious to ensure executives devote their time to continuing the level of performance, while weaker companies will expect executives to invest their time trying to improve performance. From a demand-side perspective however, executives perceived as being effective managers are more likely to be offered non-executive directorships in other companies since firm performance is expected to be an important benchmark used by companies seeking to appoint non-executives. Indeed, Ferris et al. (2003) report that past accounting performance has a positive impact on the number of additional directorships held by directors as well as on the likelihood that a director will be offered an additional directorship. Taking supply and demand influences together, therefore, past performance is expected to exert a positive influence on the likelihood of executives holding outside directorships.

Booth and Deli (1996) approach the issue of performance from a different perspective. In particular, they argue that an important influence on an executive's value to his company is the existence of future growth opportunities and the need for these to be maximised for the benefit of shareholders. Therefore, companies consisting mainly of assets-in-place are unlikely to benefit greatly from having senior executives serving as non-executive directors elsewhere. Instead, companies with greater growth opportunities are expected to gain most by having their executives serve on the boards of other companies. This argument builds on Smith and Watts' (1992) suggestion that the marginal product of investment decision-makers is greater than the marginal product of supervisors and that good investment decision-makers are more scarce than good supervisors. Senior executives however, are only creating value for their companies while they are working in their companies' interests. All else equal, activities that draw senior executives' attention away from their executive duties are expected to be more costly for companies where executives are investment decision-makers (i.e. companies made up largely of growth opportunities) rather than managers of existing assets. Even though we do not know whether the costs or benefits of additional directorships rise faster with growth opportunities, it is reasonable to expect that the benefits of additional directorships are less sensitive to the nature of a company's investment opportunities

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[1] It should be noted that Fich and White (2000) find a positive association between the presence of CEO interlocks and Tobin's q. Fich and White (2000) suggest that the different result in their study may be due to: (a) Booth and Deli's (1996) use of the market-to-book ratio rather than Tobin's q and, (b) their focus on reciprocal directorships rather than just the number of additional directorships held.

Table 1
Frequency of non-executive directorships held by executive directors

Number of non-executive directorships	*All executive directors*	*CEOs*	*Non-CEO executives*
0	2,294	382	1,912
1	189	80	109
2	58	30	28
3	18	8	10
4	2	–	2
5	1	–	1
6	2	–	2
Total	**2,564**	**500**	**2,064**

than are the costs of additional directorships. Consistent with their prediction, Booth and Deli (1996) find that CEOs of companies with greater growth opportunities hold fewer additional directorships.[1]

2.5. Other factors

Booth and Deli (1996) identify a number of additional factors that may influence executive directors' possession of additional directorships. For example, they argue that company size may proxy for the contracting environment of the company. Larger firms are expected to have more external contracting relationships than smaller firms and consequently have more to gain from well-bonded relationships. Better bonding of contracting relationships predicts a positive relationship between firm size and the number of additional directorships held by executives. Peasnell et al. (1999) find that company size is an important influence on the likelihood that an executive possesses a non-executive directorship and suggest this may be influenced by the fact that larger companies are more visible and companies prefer high-profile board members. Of course, a supply-side interpretation of Peasnell et al's (1999) finding suggests that companies are less likely to release executives to serve as non-executives in companies smaller than themselves as the benefits of such an appointment to the executive's company are less obvious.

The longer an executive serves on the board the more of a known quantity he/she becomes suggesting that board tenure has an impact on the board's policy towards his acceptance of additional directorships. Similarly, on the demand side, other companies are more likely to demand the services of executives with longer tenure as directors. Booth and Deli (1996) and Fich and White (2000) find that CEO tenure has a positive impact on the number of additional directorships and reciprocal interlocks held by CEOs, respectively.

3. Sample, variable description and summary statistics

The past decade witnessed a significant change in the governance characteristics of UK companies. In the wake of the recommendations of the *Committee on the Financial Aspects of Corporate Governance* (Cadbury, 1992), listed companies significantly increased their use of non-executive directors. In designing this study, I decided to focus on executives' holdings of non-executive directorships immediately preceding the widespread adoption of the Cadbury (1992) recommendations. Consequently, I began by using the *Financial Times* to construct a list of the 1,000 largest companies in the UK at the end of 1991, based on market capitalisation. I excluded financial and other regulated companies on the grounds that they face different governance, regulatory and accounting environments than other companies. I then selected the largest remaining 500 companies. The main sources of information for the study were companies' published annual report and accounts for 1991, together with the *Arthur Andersen Corporate Register* which provided information on directorships held by directors in UK listed companies. I used *Datastream* to obtain financial variables. The final sample consists of 500 companies and includes 2,564 executive directors. These directors account for a total of 2,948 board seats.

Table 1 presents summary statistics on the holdings of non-executive directorships by executives in the sample. It is worth noting that, when measuring the number of additional directorships held by executives, I count directorships in all quoted companies (excluding investment trusts); directorships in unlisted companies are ignored. I am not constrained to within-sample directorships. As can be seen from Table 1, 270 executives (10.5%) hold at least one additional directorship. CEOs are the principal holders of additional directorships. Of the 500 CEOs in the sample, 118 (23.6%) possess at least one additional directorship. Extrapolating from Table 1, each

Table 2
Summary statistics of company characteristics

Variables[1]	*Mean*	*Median*	*Minimum*	*25th Percentile*	*75th Percentile*	*Maximum*
Directors	8.5	8.0	3.0	6.0	10.0	20.0
% non-executive directors	38.7	40.0	0.0	28.6	50.0	80.0
CEO duality	0.33	0.0	0.0	0.0	1.0	1.0
Company has an executive serving as a non-executive	0.42	0.0	0.0	0.0	1.0	1.0
% ownership of executive directors	5.99	0.45	0.0	0.07	5.34	73.9
Market-to-book ratio	2.3	1.8	0.2	1.1	2.8	15.7
Return on capital employed	23.0	21.5	–4.6	15.9	28.4	85.1
Market capitalisation (£m)	718.0	147.0	16.0	69.5	453.0	18,300.0
Executive tenure	5.4	4.0	1.0	2.0	6.0	54.0

[1] Variable definitions:
Directors = total number of directors on the company's board; *% non-executive directors* = the proportion of board directors that are not full-time employees of the company; *CEO duality* = a binary variable taking the value of 1 if the same person occupies the positions of company chairman and CEO, = 0 otherwise; *Company has an executive serving as a non-executive* = a binary variable taking the value of 1 if one or more of a company's non-executive directors is a serving executive in another listed company, =0 otherwise; *% ownership of executive directors* = the proportion of equity held by executive board members; *Market-to-book ratio* = the market value of the company's equity at the accounting year end divided by book value of equity at that date; *Return on capital employed* = average return on capital employed for the three financial years preceding 1991 (defined as: net profit before taxation divided by total net assets (%)); *Market capitalisation* = the market value of equity at the accounting year end; *Executive tenure* = the number of years an executive has served on the board of directors (periods of less than one year are given the value of 1).

executive possesses an average of 0.15 additional directorships with a corresponding average for CEOs of 0.33. This compares with 1.87 additional directorships held by CEOs in the Booth and Deli (1996) study in the US. The findings presented here suggest that the holding of multiple directorships by CEOs is significantly greater in large US companies compared with the UK. Of particular interest is the relatively low level of additional directorships held by non-CEO executives in the sample. The average number of additional directorships held by non-CEO executives is only 0.11, with 92.6% of non-CEO executives holding no additional directorships.

The findings of Ward's (1998) survey suggests that companies often impose a cap on the number of additional directorships held. During the period under study the details of such policies were typically not disclosed in companies' annual report and accounts. I am therefore unable to capture the extent to which companies restrict their executives from holding additional directorships. This is an important limitation that needs to be considered when discussing the results.

Summary statistics for the variables used in the study are presented in Table 2. Three variables are used to represent board composition and leadership: the proportion of board members that are non-executive, a binary variable indicating companies where the same individual occupies the positions of company CEO and chairman, and a binary variable taking the value of one where the company's cohort of non-executive directors includes one or more executives from another listed company (excluding investment trusts). The average representation of non-executive directors in the sample is 39%, while 33% of companies had the same individual occupying the positions of CEO and chairman. Some 42% of companies had at least one executive from another company serving

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[2] Booth and Deli (1996) use a more specific definition of outside directors than the one used in this study. Specifically, former employees, relatives, blockholders, persons deriving personal benefits (e.g. consulting fees and personal loans), and members of firms with contracting relations with the firm (e.g. auditors, bankers, lawyers, etc.) are not classified as outside directors. Consequently, the average representation of outsiders reported in their study would be even higher if the definition of an outside director was consistent between the two studies. However, in the period being studied, UK companies rarely provided sufficient information on their directors to facilitate a distinction between different categories of non-executive directors.

Table 3
Pearson correlation coefficients between the independent variables[1]

Variables[2]	*1*	2	*3*	*4*	*5*	*6*	*7*	*8*
1. % non-executive directors	1.0							
2. CEO duality	–0.160	1.0						
3. Company has an executive serving as a non-executive	0.289	–0.148	1.0					
4. % ownership of executive directors	–0.324	0.222	–0.195	1.0				
5. Market-to-book ratio	0.010	0.026	0.008	0.098	1.0			
6. Return on capital employed	–0.100	0.077	–0.060	0.161	0.499	1.0		
7. Log of market capitalisation	0.110	0.007	0.256	–0.274	0.207	–0.072	1.0	
8. Executive tenure	–0.056	0.072	–0.067	0.075	–0.032	0.005	0.001	1.0

[1]Correlations ± 0.06 and 0.04 are significant at 1% and 5% respectively.
[2]Definitions of the variables used are provided as a note to Table 2.

as a non-executive on their board of directors. Comparisons with Booth and Deli's (1996) data for US companies are useful bearing in mind the similar samples size and broadly similar timing of the studies. Booth and Deli (1996) report unaffiliated outsider representation of 59%,[2] CEO duality of 81% and an average of 1.55 CEOs serving as non-executives on each company's board. These comparisons illustrate the significant differences between US and UK companies in terms of board composition and leadership.

I use the proportion of total shares outstanding held by executive directors to represent executive ownership.[3] The average ownership of executive directors in the sample is 6%. I use market capitalisation to represent company size. Similar to Booth and Deli (1996), I use the market-to-book ratio as a proxy for growth potential. I use the average of return on capital employed for the three preceding years to represent prior performance. Finally, I include a variable to measure the number of years executives served as directors of their companies. The average executive in the sample had served for five years. I could obtain tenure information for only 1,776 executives. At the time of the study, companies did not consistently reveal such information in their annual reports and accounts.

4. Empirical results

Table 3 contains correlation coefficients between the explanatory variables used in the subsequent regression analysis. Correlations are important in governance-related studies since the interaction between governance mechanisms is helpful in trying to understand the emphasis companies place on different mechanisms. For example, the significant negative correlation between non-executive representation and executive ownership suggests that board independence and managerial ownership appear to be substitute governance mechanisms. This is reinforced by the negative correlation between non-executive representation and CEO duality, and the positive correlation between CEO duality and executive share ownership. The correlations in Table 3 also highlight a significant positive correlation between the proportion of non-executives on the board and the likelihood of having a current executive from another company serving as one of those non-executives. This suggests that companies that emphasise non-executive representation may also feel it is important to have executives from other companies serving as non-executives. The negative correlation between the presence of an executive from another company on the cohort of non-executives and executive ownership suggests a reduced need for executives as non-executives in companies where shareholder-manager conflict might be expected to be less severe. Finally, the correlations presented in Table 3 also highlight the importance of company size on the different emphasis placed on governance mechanisms. For example, large companies appear to favour the use of greater non-executive representation, are more likely to have an executive from another company as a non-executive, and exhibit lower levels of executive ownership.

One of the interesting findings from Table 1 is the high proportion of executives holding no additional directorships in other quoted companies

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[3] I exclude share options held by executives in the calculation of this variable.

Table 4
Results of a logit analysis of the factors influencing executives' possession of non-executive directorships in other UK-quoted companies

	Model 1		*Model 2*	
Variables[1]	*coefficient*	*p-value*	*coefficient*	*p-value*
% non-executive directors	0.0212	0.0000	0.0254	0.0000
CEO duality	0.0145	0.9229	–0.0482	0.7870
Company has an executive serving as a non-executive	0.1159	0.4182	0.1927	0.2488
% ownership of executive directors	–0.0165	0.0868	–0.0214	0.1171
Market-to-book ratio	0.0004	0.9935	0.0292	0.5823
Return on capital employed	–0.0026	0.7549	–0.0082	0.4227
Log of market capitalisation	0.6270	0.0000	0.6059	0.0000
Executive tenure			0.0714	0.0000
Constant	–8.2368	0.0000	–8.5760	0.0000
Likelihood ratio statistic[2]	*99.8277*	*0.0000*	*114.3083*	*0.0000*
Observations	*2564*		*1776*	

[1]Definitions of the variables used are provided as a note to Table 2.
[2]The Likelihood ratio statistic is defined as: 2X(log likelihood at convergence – log likelihood at zero). The statistic tests the null hypothesis that all model parameters are equal to zero. Under this hypothesis, the likelihood ratio statistic is asymptotically distributed as a chi-square. The degrees of freedom are equal to the number of parameters in the model.

(89.5%). In view of this, a key issue is to try and understand why some executives hold additional directorships and why others do not. To address this issue, I use a binary variable to distinguish between executives holding at least one additional directorship and those holding none. Consequently, the regressions presented in Table 4 use a logit regression since the dependent variable is binary. I present the results of separate regressions excluding and including tenure since the inclusion of this variable significantly reduces the number of observations.

Board composition has a positive and significant impact on the holding of additional directorships. As non-executive representation increases, executives are more likely to possess an additional directorship. There is no evidence that the presence of CEO duality or the presence of a current executive on the company's roster of non-executives have a significant impact on the likelihood of holding an additional directorship. The proportion of equity owned by executive directors has a negative but only marginally significant impact on the likelihood of executives holding additional directorships. Neither return on capital employed nor market-to-book ratio has a significant impact on the regressions in Table 4. This suggests that the likelihood of executives holding outside directorships is not influenced either by past accounting performance or future growth opportunities. The likelihood of holding an additional directorship is positively related to company size. This is consistent with executives in larger companies possessing a broader range of contacts and are consequently more likely to be offered board seats. Another possible explanation may be the desire on the part of smaller companies to appoint their non-executives from larger companies.[4] In model 2 of Table 4, the length of executive tenure increases the likelihood of executives possessing additional directorships. This finding is consistent with the notion that the longer an executive serves on the board the more of a known quantity he/she becomes and this knowledge is expected to have an impact on the board's policy towards the acceptance of a directorship elsewhere. This finding is also consistent with the demand-side argument that executives with longer tenure become better known to other companies and consequently are

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[4] I have compared the size (using market capitalisation) of companies where executives hold at least one additional directorship with the size of the companies in which they hold these additional directorships (I used the largest additional company in instances where more than one additional directorship was held). Some 56.7% of host companies are larger than their additional company counterparts. The median additional directorship company was 1.29 times the size of the company where the additional directorship(s) was held.

Table 5
Estimated probabilities of executives holding an additional directorship in other UK-quoted companies (probability of holding an additional directorship with all variables at their means = 0.092)[1]

	10th Percentile		*Median*		*90th Percentile*	
Variables[2]	*Value*	*Probability*	*Value*	*Probability*	*Value*	*Probability*
% non-executive directors	16.667	0.058	37.5	0.094	55.556	0.141
CEO duality	0.0	0.093	0.0	0.093	1.0	0.089
Company has an executive serving as a non-executive	0.0	0.085	0.0	0.085	1.0	0.101
% ownership of executive directors	0.013	0.101	0.278	0.100	13.947	0.077
Market-to-book ratio	0.667	0.088	1.829	0.091	4.275	0.097
Return on capital employed	10.60	0.101	21.423	0.093	35.977	0.083
Log of market capitalisation	7.634	0.058	8.318	0.086	9.445	0.156
Executive tenure	1.0	0.069	4.0	0.084	12.0	0.140

[1]The logit regression in model 2 of Table 4 is used to estimate the probabilities.
[2]Definitions of the variables used are provided as a note to Table 2.

more likely to receive offers of additional directorships.

A potential weakness of logit regression is that the strength of the impact of the independent variables is not easily identifiable. A useful method of discussing the influence of independent variables therefore is to examine predicted probabilities. Table 5 contains the estimated probabilities from model 2 in Table 4.[5] The value of each of the explanatory variables is alternated between its value at: the 10th percentile, the median and the 90th percentile, holding all remaining variables constant at their mean values. At the base case, where all variables are at their mean values, the probability of a director holding an additional directorship is 9.2%. In respect of board composition and leadership, the results in Table 5 show that as non-executive representation increases from 16.7% to 37.5%, the likelihood of an executive holding an additional directorship increases from 5.8% to 9.4% respectively. When non-executive representation is at 55.56% the likelihood increases to 14.1%. The presence of a current executive on a company's cohort of non-executives increases the likelihood of a director possessing an additional directorship from 8.5% to 10.1%. As suggested by the logit regressions in Table 4, CEO duality has little discernable impact on the likelihood of holding an additional directorship.

As highlighted by many previous studies, the percentage ownership of executives is significantly skewed with relatively few companies possessing executives with a significant ownership stake. At low levels of ownership, the probability of holding an additional directorship is around 10%. As ownership increases to 13.95% (90th percentile), the probability decreases to 7.7%. Changes in the market-to-book or ROCE variables exert little influence on the likelihood of holding an additional directorship. The number of years an executive has served on the board of his company does have a significant impact on the likelihood of holding an additional directorship. For example, the probability of executives with tenure of one year or less holding an additional directorship is 6.9%. This increases to 8.4% with four years' tenure and increases to 14% where a director has been on the board for 12 years. Finally, the predicted probabilities in Table 5 highlights the significant impact that company size has on the likelihood that directors possess an additional directorship. Extrapolating from Table 5, as market capitalisation changes from around £43 million (10th percentile) to around £208m (median), the likelihood of an executive holding an additional directorship increases from 5.8% to 8.6%. When market capitalisation is £2.79 bn (90th percentile), the likelihood of holding an additional directorship increases to 15.6%. This shows that while size is an important determinant of the holding of additional directorships, its impact is especially pronounced in the case of executives in very large companies.

In addition to seeking to explain why some executives hold additional directorships and others

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[5] Model 2 in Table 4 was chosen to include tenure since this variable has a significant and positive impact in Table 4 even though the number of observations reduces from 2,564 to 1,776.

Table 6
Results of a logit analysis of the factors influencing CEOs' and non-CEOs' possession of non-executive directorships in other UK-quoted companies

	CEOs				*Non-CEOs*			
	Model 1		*Model 2*		*Model 1*		*Model 2*	
Variables[1]	*coefficient*	*p-value*	*coefficient*	*p-value*	*coefficient*	*p-value*	*coefficient*	*p-value*
% non-executive directors	0.0208	0.0125	0.0154	0.1320	0.0121	0.0638	0.0209	0.0089
CEO duality	0.6768	0.0085	0.5090	0.1272	–0.3720	0.0789	–0.1077	0.6621
Company has an executive serving as a non-executive	0.1139	0.6483	0.2540	0.3847	0.1708	0.3608	0.1300	0.5487
% ownership of CEO	–0.0149	0.3675	0.0028	0.9220	–0.0667	0.0793	–0.3028	0.0349
% ownership of non-CEO executives	–0.0225	0.4243	0.0037	0.8896	0.0038	0.8129	0.0010	0.9633
Market-to-book ratio	–0.0379	0.6435	–0.1024	0.3097	0.0094	0.8748	0.0823	0.2088
Return on capital employed	–0.0075	0.6015	–0.0070	0.6935	0.0013	0.9096	–0.0105	0.4396
Log of market capitalisation	1.0923	0.0000	1.1723	0.0000	0.6316	0.0000	0.4796	0.0027
Executive tenure			0.0113	0.6056			0.0681	0.0000
Constant	–11.1636	0.0000	–11.4928	0.0000	–8.3375	0.0000	–7.5983	0.0000
Likelihood ratio statistic[2]	65.9213	*0.0000*	45.2827	*0.0000*	*64.7874*	*0.0000*	*77.8571*	*0.0000*
Observations	500		*323*		*1,776*		*1,453*	

[1] Definitions of the variables used are provided as a note to Table 2.

[2] The likelihood ratio statistic is defined as: 2X(log likelihood at convergence – log likelihood at zero). The statistic tests the null hypothesis that all model parameters are equal to zero. Under this hypothesis, the likelihood ratio statistic is asymptotically distributed as a chi-square. The degrees of freedom are equal to the number of parameters in the model.

do not, I am also interested in examining the impact of the explanatory variables in explaining the number of additional directorships held by individual executives. Due to the low dispersion of the dependent variable (i.e. ranging between 0 and 6 additional directorships) the dependent variable is likely to be best modelled by using either a poisson or a negative binomial regression (Greene, 2003). I used both techniques and found that the poisson distribution was more appropriate. Because of the broadly similar findings of the logit and poisson regressions and due to space constraints, I have not shown the results of the poisson regressions separately in the paper. However, it is useful to highlight and discuss where the results differed. Similar to the findings reported in Table 4, board composition, size and tenure exert a significant positive impact on the number of additional directorships held by executives. However, in the poisson regression, the negative impact of executive ownership is particularly significant ($p = 0.01$). This suggests that owner-managers are less inclined to accept multiple directorships but focus their attention on maximising wealth within their own companies.[6]

From a governance perspective these findings are reassuring. They suggest that executives in companies with stronger board monitoring, as represented by a higher proportion of non-executive directors, are more likely to possess additional directorships and are likely to hold a greater number of such directorships. This is consistent with the notion that possession of additional directorships by executives is perceived as beneficial to their companies and independent boards encourage executives to hold such appointments. Of course, we also know from Table 1 that the average number of additional directorships held by individual executives is low, which suggests that strong board governance may also discourage executives from holding too many such appointments. This evidence is also consistent with a greater demand for executives from companies with potentially more independent boards to serve as non-executives elsewhere. The negative impact of executive ownership, especially in restraining the number of directorships, is consistent with owner-managers focusing their attention on company affairs and consequently pursuing shareholders' interests rather than potentially prestigious external directorships. Of course, this finding is also consistent with a lower demand for owner-managers to serve as non-executives in other companies, perhaps due to a perceived lack of transferable knowledge.

In view of the summary statistics presented in Table 1 that identified CEOs as the principal holder of additional directorships, Table 6 presents the results of logit regressions for CEOs and non-CEO executives separately. The regression results presented in Table 6 show that board composition has a positive impact on the holding of additional directorships both by CEOs and non-CEOs. Table 6 also shows that CEOs who are chairmen of their companies are more likely to possess additional directorships. Interestingly, CEO duality appears to have the opposite impact in the case of non-CEOs, executives in CEO duality companies are less likely to hold an additional directorship. These findings suggest that CEO/chairmen may use their dominant position on company boards to accept outside directorships themselves but discourage their executives from doing so. However, it may also suggest that other companies are reluctant to offer directorships to executives from CEO duality companies. I include separate variables to represent the ownership of CEOs and non-CEOs. Even though neither of these two variables are significant in the CEO regressions, CEO ownership has a negative impact on the likelihood of non-CEOs holding an additional directorship. This may provide further evidence of CEO influence in the holding of additional directorships by executives since CEOs with significant ownership may discourage the holding of non-executive directorships by their executive colleagues. Company size has a positive and significant impact in both the CEO and non-CEO regressions. Interestingly, tenure is positive and significant in the case of non-CEOs but is insignificant in the case of CEOs. This suggests that once an executive reaches the CEO position, he/she is automatically in the market for additional directorships while non-CEOs require longer tenure prior to being offered (or prior to being allowed to accept) an outside directorship.

Table 7 provides further insights on the impact of the independent variables in the CEO and non-CEO regressions presented in Table 6. Similar to Table 5, I include 10th percentile, median and 90th percentile values for each of the independent variables and show the impact on the implied probability of holding an additional directorship. In the case of CEOs, the simultaneous holding of the position of chairman has a noticeable impact on the likelihood of possessing an additional directorship. When a CEO holds both positions the probability of possessing an additional directorship increases from 22.6% to 32.6%. In the case of non-CEOs, the impact is in the opposite direction but of a much smaller magnitude: the probability decreases from 3.7% in companies with separate CEOs and chairman to 3.4% in companies with CEO du-

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[6] As a sensitivity test, I re-estimated the poisson regressions excluding the five instances where executives held four or more additional directorships in order to explore whether these cases were driving the empirical results. When these cases are excluded, the positive impact of non-executive representation is stronger ($p = 0.01$) while the negative impact of executive ownership weakens ($p = 0.03$).

Table 7
Estimated probabilities of CEOs (non-CEOs) holding an additional directorship in other UK-quoted companies. The probability of holding an additional directorship with all variables at their means = 0.251 (0.036)[1]

	10th Percentile		*Median*		*90th Percentile*	
Variables[2]	*Value*	*Probability*	*Value*	*Probability*	*Value*	*Probability*
% non-executive directors	21.746 (15.385)	0.200 (0.024)	42.857 (37.5)	0.257 (0.037)	60.0 (54.545)	0.310 (0.053)
CEO duality	0.0 (0.0)	0.226 (0.037)	0.0 (0.0)	0.226 (0.037)	1.0 (1.0)	0.326 (0.034)
Company has an executive serving as a non-executive	0.0 (0.0)	0.229 (0.034)	0.0 (0.0)	0.229 (0.034)	1.0 (1.0)	0.277 (0.039)
% ownership of CEO	0.001 (0.001)	0.249 (0.078)	0.040 (0.053)	0.250 (0.077)	4.231 (6.682)	0.252 (0.011)
% ownership of non-CEO executives	0.005 (0.006)	0.249 (0.036)	0.089 (0.114)	0.249 (0.036)	7.233 (7.255)	0.254 (0.036)
Market-to-book ratio	0.728 (0.667)	0.281 (0.032)	1.831 (1.821)	0.259 (0.035)	4.067 (4.579)	0.218 (0.043)
Return on capital employed	11.674 (10.452)	0.265 (0.041)	21.360 (21.423)	0.252 (0.037)	34.623 (36.728)	0.235 (0.031)
Log of market capitalisation	7.606 (7.653)	0.120 (0.025)	8.243 (8.332)	0.224 (0.034)	9.311 (9.466)	0.502 (0.057)
Executive tenure	1.0 (1.0)	0.237 (0.028)	5.0 (3.0)	0.245 (0.032)	17.0 (11.0)	0.271 (0.054)

[1] The logit regressions in model 2 (CEOs) and column 4 (non-CEOs) of Table 6 are used to estimate the probabilities.
[2] Definitions of the variables used are provided as a note to Table 2.

ality. High levels of CEO ownership have a noticeable impact on the likelihood of non-CEOs holding an additional directorship. For example, when ownership changes from 0.001% to 0.053%, the likelihood of non-CEOs holding an additional directorship decreases from 7.8% to 7.7%. However, when CEO ownership is 6.7% the likelihood of a non-CEO holding an additional directorship reduces to only 1.1%. Ownership of non-CEOs appears to exert little effect on the holding of additional directorships for either type of executive. Both company size and tenure have a strong impact on the likelihood of CEOs holding additional directorships. The impact of company size is very noticeable in the case of CEOs, especially in the case of large companies. Extrapolating from Table 7, the likelihood of a CEO of a company with market capitalisation of £2.04bn holding an additional directorship is 50.2%.

I also undertook separate poisson regressions in an attempt to understand the influence of the explanatory variables on the number of additional directorships held by CEOs and non-CEOs. In the case of CEOs, both non-executive representation and CEO duality exert a positive and significant influence on the number of additional directorships held with p values < 0.01. As in the logit regression, company size also has a significant and positive impact, while neither executive ownership nor tenure are significant. In the case of non-CEOs, the negative impact of both CEO duality (p = 0.01) and CEO ownership (p = 0.03) are especially pronounced in the poisson regressions, while the impact of the proportion of non-executive directors is not significant.

In view of the significant influence of company size on the holding of additional directorships by executives, I partitioned the sample according to firm size in order to obtain further insights. Table 8 presents the results of separate regressions for executives using the median market capitalisation (£147m) to distinguish between large and small companies. Of the 1,442 executives in the large sub-sample, 207 (14.4%) held an additional directorship. Only 63 of the 1,122 (5.6%) executives in the small sub-sample held an additional directorship. In the case of larger companies, board composition, size and tenure all exert a positive and significant influence on the likelihood of executives possessing an additional directorship. In the case of smaller companies, none of the explanatory variables has a significant influence. The results of poisson regressions on the large company sub-samples reveal similar results to the logit regressions. In the case of smaller companies however, the presence of CEO duality and executive ownership exert a significant and negative impact on the number of additional directorships held.

5. Sensitivity analysis

In order to examine the robustness of the regression results I undertook a number of sensitivity tests. I investigated the possibility of multicollinearity between return on capital employed and the market-to-book ratio as their correlation coefficient in Table 3 is 0.5. However, when I re-estimated the regressions by interchanging the use of these variables the results remained unchanged. Furthermore, none of the Variance Inflation Factors (VIF) in the logit regression exceeds 1.3, and since it is widely believed that only values in excess of 10 suggest serious multicollinearity, I am reasonably confident the regression results are not impaired.

In order to exclude the possibility that the regression results may be influenced by the highly skewed nature of executive ownership, I transformed the executive ownership data using the natural log and re-estimated the regressions. This transformation did not significantly alter the overall regression results or the overall fit of the models but it did emphasise the significance of executive ownership in most of the regressions. For example, the negative significance of executive ownership increases from $p = 0.09$ in model 1 of Table 4 to $p = 0.01$ when the log is used. In the non-CEO regressions, the significance of CEO ownership increases from $p = 0.08$ in model 3 of Table 4 to $p = 0.01$ when the log is used. The results of the poisson regressions are largely unchanged when I substitute the log values. This transformation seems to suggest that executive ownership does reduce the likelihood of executives holding additional directorships and, in particular, confirms the negative impact of CEO ownership on the likelihood of non-CEOs holding outside directorships.

I also tested for the possibility that executive ownership may have a different impact on the holding of additional directorships at different ownership levels. This was prompted by the empirical findings of such studies as Morck et al. (1988) and Short and Keasey (1999) who provide evidence of managers pursuing shareholder objectives at low and high levels of managerial ownership but pursuing entrenchment at intermediate levels of ownership. Consequently, I re-estimated both the logit and poisson regressions to include a binary variable denoting executive ownership levels between 12% and 42% (the two critical ownership levels identified by Short and Keasey (1999).[7] In the case of all three sub-samples the entrenchment variables had no significant impact on the likelihood of executives possessing an additional

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[7] The findings of Short and Keasey (1999) are especially relevant to this study as their work also utilised pre-Cadbury data.

Table 8
Results of logit regressions of the factors influencing the likelihood of executives possessing an additional directorship in other UK-quoted companies partitioned on the basis of company size. The large company sub-sample consists of executives in companies with market capitalisation > £147m (median) while the small company sub-sample consists of executives from companies with market capitalisation ≤ £147m

	Large companies				*Small companies*			
	Model 1		*Model 2*		*Model 3*		*Model 4*	
Variables[1]	*coefficient*	*p-value*	*coefficient*	*p-value*	*coefficient*	*p-value*	*coefficient*	*p-value*
% non-executive directors	0.0261	0.0000	0.0296	0.0000	0.0078	0.3989	0.0123	0.2824
CEO duality	0.1213	0.4783	0.0574	0.7759	–0.3615	0.2650	–0.6369	0.1469
Company has an executive serving as a non-executive	0.0578	0.7265	0.2770	0.1555	0.1670	0.5577	–0.1377	0.6974
% ownership of executive directors	–0.0104	0.3909	–0.0220	0.2388	–0.0265	0.1067	–0.0142	0.4784
Market-to-book ratio	–0.0154	0.7667	0.0446	0.4528	0.0014	0.9913	–0.0649	0.7047
Return on capital employed	0.0051	0.6728	–0.0114	0.4192	–0.0090	0.4793	–0.0009	0.9505
Log of market capitalisation	0.5124	0.0006	0.3963	0.0221	–0.1117	0.8396	0.2638	0.7043
Executive tenure			0.0936	0.0000			–0.0016	0.9586
Constant	–7.4907	0.0000	–7.0093	0.0000	–1.8073	0.6750	–4.8843	0.3692
Likelihood ratio statistic[2]	44.1899	0.0000	82.3261	0.0000	14.9439	0.1024	7.4015	0.4940
Observations	1,442		1,061		1,122		715	

[1] Definitions of the variables used are provided as a note to Table 2.

[2] The likelihood ratio statistic is defined as: 2X(log likelihood at convergence – log likelihood at zero). The statistic tests the null hypothesis that all model parameters are equal to zero. Under this hypothesis, the likelihood ratio statistic is asymptotically distributed as a chi-square. The degrees of freedom are equal to the number of parameters in the model.

directorship. In the poisson regressions however, the entrenchment variable had a negative impact on the number of additional directorships held in both the full sample ($p = 0.02$) and the sample of non-CEO executives ($p = 0.05$), but was not significant in the CEO regression. This evidence suggests that executives in the intermediate ownership category are even less likely to possess additional directorships, a finding not necessarily consistent with entrenchment behaviour by these executives.

6. Conclusions

This paper has sought to provide insights on the use of executive directors as non-executives in other large companies immediately prior to the governance reforms of the mid-1990s. The study looked at factors determining both the likelihood of executives holding additional directorships as well as the number of directorships held. The empirical results suggest that the possession of additional directorships by executives at this time was not widespread. The average number of additional directorships held by each executive was 0.15 with CEOs being the principal holder of such positions possessing an average of 0.33. Indeed, 89.5% of executives (76.4% of CEOs) held no additional directorships.

Executives in companies with stronger board monitoring, represented by a higher proportion of non-executive directors, were more likely to possess additional directorships and were likely to hold a greater number of such directorships. Viewed in the context of the low incidence of executives holding multiple directorships overall, this result suggests that more independent boards encouraged their executives to hold additional directorships but not so many as might impair shareholder wealth. This finding is also consistent with a greater demand for executives from companies with potentially more independent boards to serve as non-executives. The study also found that CEO duality had a positive impact on both the likelihood and number of additional directorships held by CEOs. This may suggest that such CEOs are in a position to pursue more self-interested behaviour and the possession of additional directorships may be evidence of this. Managerial ownership had a negative impact on both the likelihood of executives possessing additional directorships and the number of directorships held. When the sample is partitioned between CEOs and non-CEOs, CEO ownership is found to have a negative impact on non-CEOs' holding of directorships. This is consistent with CEOs who have significant equity in their companies discouraging other executives from holding directorships that may divert their attention from wealth maximisation in their own companies.

The study also finds that the holding of additional directorships was more likely in larger companies and the longer an executive had served on the board. The impact of size suggests that the wider contracting environment in which larger firms operate may expose executives to more offers of non-executive positions. This may also reflect the greater visibility of larger companies and their executives in the business environment and smaller companies may perceive benefits in having such high-profile executives on their boards. The longer an executive serves on a company's board the more of a known quantity he/she becomes and this might explain the positive impact of tenure. In addition, on the demand side, other companies are more likely to demand the services of more experienced executives. In the case of CEOs, tenure did not have an impact on the likelihood of holding additional directorships. This may suggest that once an executive reaches the CEO position he/she is automatically in the market for additional directorships.

Even though this study provides important insights on the holding of additional directorships by executives prior to the Cadbury-related reforms of the 1990s, several limitations of the study are worthy of note. The UK governance environment has changed significantly in the past decade and consequently this study says little about the current market for additional directorships. The study is also restricted to analysing additional directorships executives have accepted. This is an important limitation for two reasons. First, we have no information on the extent to which executives in the sample had refused non-executive offers. Second, we have no information on individual companies' policies towards their executives accepting additional directorships, especially policies that limit the number of directorships executives can hold. The work of Ward (1988) and Peasnell et al. (1999) suggest that such policies often exist. Both these issues potentially compromise the empirical results reported here, as both the likelihood and number of additional directorships may not be based solely on economic factors.

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Book review

A survey of European investor relations. *Claire Marston.* Institute of Chartered Accountants of Scotland, 2004. xii+168pp. £15.

The aim of this research project was to find out the extent to which investor relations has become established within top companies in Europe. Postal questionnaires were sent to the top 500 quoted European companies in 2002 in 18 different countries. This was followed up with a series of 19 interviews with investor relations personnel from six countries. The report provides a clear and up-to-date picture on what large European companies are doing in the area of investor relations.

Nearly all respondent companies (90%) had a full-time investor relations (IR) officer. The average investor relations department had been established around seven years. The average investor relations budget was £609K and companies spent on average £350K on investor relations and £250K on financial public relations consultants. One-to-one meetings were ranked most important by respondents, with telephone calls a close second. These were followed by (in order of importance), roadshows, providing feedback on analysts' reports and answering e-mail queries. On average companies had held 112 one-to-one meetings each in the previous year. They had met 36 stockbroking firms and 110 investing institutions. The most important topics of discussion were company strategy, major new projects and developments, explanation of recent results and the creation of shareholder value. Similar insights are provided for company responses to analysts reports and forecasts, corporate use of websites for investor relations, and how the IR activity was perceived to impact on the stock price.

It is difficult to argue with many of these useful facts, insights, and perceptions. These results provide solid and essential reference points for other researchers exploring corporate disclosure through public and private channels (Barker, 1998; Holland, 1998; Weetman and Beattie, 1999). Given the above results, it may therefore be more useful for a reviewer to briefly point out what we do not know in this area and how research can progress from this point.

The costs and benefits of the IR function and of associated disclosure activity were discussed, but it was not clear what the actual cost benefit equation was for the companies concerned. The underlying cost benefit equation in the theoretical literature could be based on costs of information production in IR, and of propriety costs of disclosure (Healy and Palepu, 2001). Perceived benefits could include a reduced information asymmetry between company and core analysts and shareholders, a stable shareholder base, and a stable reputation for credible disclosures with analysts. Capital market benefits could include a high quality information set in the price and hence an improved share rating and performance, lower price volatility, a narrower bid offer spread and higher liquidity, and these were expected to lead to a lower cost of equity capital. New surveys and interviews could probe for these costs and benefits and provide examples of how companies knew or perceived cost of capital benefits.

The study did not explore how the various communication channels interacted with each other as one IR and corporate disclosure system and how they could substitute for each other. This total system view leads to many new questions. Previous one-and-one meetings (with high benefits exceeding costs), were presumably the base for stable 'relationships' with analysts and fund managers. Did such a stable relationship make subsequent phone calls and roadshows more valuable? Did effective roadshows improve subsequent one-to-one meetings? Why were one-on-one meetings used when a telephone call was possible? Why was there a preference for one-and-ones inside the financial institutional investor and not inside the company?

Studies of the IR function and associated disclosure activity could also benefit by adopting an explicit theoretical structure which links IR activities to information market states (such as analyst understanding and confidence), to stock market states, and then to subsequent corporate feedback states. Some of these issues have been discussed in ch. 2 of the Marston (2004) report. This explicit theory base could help structure survey questions to explore how IR staff thought their actions had some impact on factors such as analyst understanding and confidence, and how this fed through into consensus earnings expectations, market price and volatility, and eventually to company equity cost of capital.

The statistical analysis of the results in ch. 5 was used to explore relationships such as company size and investor relations activity and effort, and positive associations were found here. However, country of origin and degree of overseas listing were not significant factors in explaining differences in IR characteristics and actions, suggesting that a global capital market and an information market were setting benchmarks for IR functions and associated disclosure behaviour. If this is the case then other variables will have to be considered in explaining IR. In particular, statistical analysis has been limited by the general lack of theory development in the various surveys of IR conducted by academics.

Further research could be placed in a wider theoretical frame, as suggested above. Such new research work is likely to be more successful if it explicitly links IR research on IR characteristics to IR disclosure action and behaviour. For example, the statistical approach could be extended by developing formal measures of hypothesised IR output such as disclosure credibility and reputation. If these constructs can also be operationalised and measured in a questionnaire and interviews, then new statistical relations of relevance to disclosure theory can be explored.

These suggestions build on the Marston (2004) report, and indicate how we can use this convincing and detailed research report as a solid base to learn much more about the nature of IR, its disclosure activity and perceived company and market outcomes.

University of Glasgow John Holland

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Decision rules for allocating a limiting factor across products in a stochastic production environment: a real options approach

Michael Bowe, Konstantinos Vonatsos and Stephanos Zarkos*

Abstract—This paper develops a real option framework to extend the current class of managerial decision rules appropriate for selecting a multi-product firm's optimal product mix in the presence of a limiting factor of production. The rules are relevant for both tactical and strategic decision making when managers are operating in an environment of earnings uncertainty. The analysis makes several contributions. The central result derives a decision rule for allocating a limiting factor across products based upon the ranking of the different products' real option values per unit of the limiting factor. This rule is shown to give a more efficient allocation of the limiting factor than other potential methods for dealing with uncertainty, for example, an allocation rule based upon a product's expected profit contribution per unit of limiting factor. Furthermore, the paper extends the results to an environment of generalised production uncertainty, clarifying the relevance of two important, but often neglected sources of production flexibility, namely intra-product and inter-product flexibility. Intra-product flexibility denotes the ability of the firm to vary the time at which a given amount of the limiting factor is dedicated to the production of a specific product, depending upon the resolution of uncertainty over the deferral period. Inter-product flexibility enables the firm to re-allocate productive capacity across products, hence alter the composition of the final product mix, for similar reasons. The analysis reveals that the value to the firm of such production flexibility depends critically upon both the revealed value of the option to defer, and the nature and extent of any correlation of price and cost changes across products.

1. Introduction

This paper extends the current class of managerial decision rules appropriate for selecting the profit maximising product mix of a multi-product firm in the presence of a limiting factor of production. A limiting factor is any aspect of the business that, over a given period of time, prevents the firm from producing all products in the quantities desired to maximise its profits, for example a short-term supply shortage in a key material input or deficiency of a particular labour skill. At a tactical level, the presence of a limiting factor necessitates the derivation of a decision rule, to determine both the composition of the production mix and the appropriate production levels. In a deterministic production and sales environment, the optimal decision rule is well-known, and can be found in standard management accounting textbooks.[1] It states that the firm should allocate the limiting factor across products according to a product's contribution to profit per unit of limiting factor. The product with the highest ranked contribution should receive the initial allocation of the factor, followed by that product with the next highest ranked contribution and so on, until the limiting factor units are exhausted.

Moreover, in addition to its tactical implications, the presence of a limiting factor is also important for decision making at a strategic management level. This fact significantly broadens the range of applications for the results of the present analysis. Capacity restrictions attributable to a limiting factor impact not only upon the scale and scope of production, but also upon the timing of such production. They are also relevant in the context of strategic decisions regarding the optimal sequencing of products, the scale and timing of any potential new market entry by a firm, and capital budgeting rules designed to analyse the value of sequential investments. Standard limiting factor

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[1] For example, see Benedict and Elliot (2001:520); Glautier and Underdown, (2001:473); Horngren, Foster and Datar (2001:396), and Arnold and Turley (1996:220).

allocation rules, formulated in the context of a deterministic production environment, may not prove particularly insightful when one attempts to extend the range of their strategic applicability to such situations.

These tactical and strategic management applications provide the motivation for this paper. The central objective of the analysis is to generalise the results of the basic deterministic model outlined above by extending it in two important directions. First, the proposed model introduces flexibility into the timing of the production process. Second, the analysis allows for uncertainty by introducing stochastic elements into the firm's earnings stream. The model is sufficiently general for the source of uncertainty to be attributable either to fluctuations in final product prices, demand conditions and/or production costs. When production can be deferred in the presence of stochastic net revenues, the relative profitability of producing different products can change during the deferral period. The appropriate way to implement the standard decision rule previously outlined then becomes indeterminate. This paper provides a general reformulation.

To extend the basic model, the present analysis develops a real options approach to choosing the optimal product mix in the presence of a limiting factor. The paper provides several new results, which are applicable at both a tactical and strategic management level. In terms of tactical applications, the central result of the paper formulates a decision rule for allocating a limiting factor across products based upon the ranking of the different products' real option values per unit of the limiting factor. We demonstrate that this rule gives a more efficient allocation of the limiting factor than other potential methods for dealing with uncertainty, for example, an allocation rule based upon a product's expected profit contribution per unit of limiting factor.[2] As the real option based decision rule introduces greater managerial complexity, in the sense that it incurs greater information and communication costs compared to more traditional approaches, we also indicate and discuss the circumstances in which the pay-off to managers from using the new rule are likely to be the greatest.

The analysis also introduces the concept of the *supporter*. The supporter is a product which effectively acts as insurance for the firm whenever a previous decision to defer production of another product turns out to be of limited value, or even worthless.[3] Furthermore, the paper extends the results to an environment of generalised production uncertainty, clarifying the importance of two potentially neglected sources of production flexibility, namely intra-product and inter-product flexibility. Intra-product flexibility denotes the ability of the firm to vary the time at which a given amount of the limiting factor is dedicated to the production of a specific product, depending upon the resolution of uncertainty over the deferral period. Inter-product flexibility enables the firm to reallocate productive capacity across products and hence alter the composition of the final product mix, for the same reason. The analysis reveals that the value to the firm of these two types of production flexibility depends critically upon the value of the option to defer, and the nature and extent of any correlation of price (cost) changes across products.

In the context of strategic managerial decision making, the paper also contributes to the literature by further extending the range of application of real options valuation methodologies. Although numerous studies examine capital budgeting decisions and the general valuation of investment projects,[4] few analyse product-related decisions. One or two exceptions are noteworthy. Kester (1993) examines a market environment where a firm's success in launching a new product is determined by the market performance of previously introduced products. Treating each product as a separate growth option, Kester demonstrates that the optimal product sequence consists of initially introducing those products having the smallest deferral premium between their option value from delaying market entry and the value that would be realised if the products were launched immediately. However, unlike the present analysis, Kester's model does not address the problem of product mix selection for simultaneous production in the presence of capacity constraints imposed by limiting factors.

Kensinger (1987, 1988) examines the value of a multi-period production facility as a portfolio of real options to exchange one set of commodities (inputs) for another set (outputs) in the presence of stochastic costs and prices. Kensinger demonstrates that the difference between the value of active production management and that obtained from traditional discounted cash flow analysis equals the expected present value of the savings made by postponing production whenever sales are expected to be unprofitable. However, the analysis assumes that the different outputs of the firm do not share any common production inputs, and requires sequential production in the sense that

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[2] As its name suggests, this rule is in many ways the natural extension of the deterministic rule, and is derived by simply recalculating a product's contribution per unit of the limiting factor using expected in place of actual values for any stochastic variables.

[3] Alternatively stated, this is the case where the option to defer ends up being insufficiently 'in-the-money', or even 'out-of-the-money'.

[4] Examples would include Busby and Pitts (1997, 1998), Childs et al. (1998), Trigeorgis (1996) and many of the papers in Brennan and Trigeorgis (2000).

Exhibit 1
Definition of notation

P_i : Price per unit of product i = A,B,....*n*
C_i : Cost per unit of product i = A,B,....*n*
TQ_i : The firms total desired production of product to i
MH_i : Machine hours required to construct one unit
TH_i : $= MH_i.TQ_i$ total number of hours required to construct quantity TQ_i
TMH : The machines total productive capacity in machine hours
H_i : Machine hours allocated to product i = A,B,....*n*
$W_i(t)$ $\frac{P_i - C_i}{MH_i}$ = Contribution to the firm's profit (earnings) per unit of limiting factor at time t.
RH : Additional hours of machine capacity the firm requires to produce all products in the desired profit maximising quantity,

$$\sum_{i=1}^{n} TH_i - TMH = RH.$$

E_i : $(P_i - C_i)TQ_i = \frac{P_i - C_i}{MH_i} TH_i$ = Total profit (earnings) from product i.
PE_i : Per unit earnings from producing product i at time t in a quantity which only partially satisfies demand.
PV_i : Present value (t=0) of earnings generated from producing product i.

the firm can only produce one product in any time period. By accommodating the possibility of contemporaneous production, the analysis in this paper both complements and extends the scope of strategic applicability of these studies.

The remainder of the paper is summarised as follows. Section 2 presents the standard product mix selection problem in the presence of a limiting factor, but in the absence of uncertainty. Section 3 reformulates the problem by introducing both flexibility in production and uncertainty in final sales revenues (profits). We then rationalise the logic of the proposed new decision rule, in the process introducing the concept of the supporter. A product acting as a supporter provides insurance for a multi-product firm whenever an earlier decision to defer production of another product turns out to be less valuable than anticipated. Section 4 presents a series of numerical illustrations of the proposed decision rule, highlighting the role of intra- and inter-product production flexibility, and also the importance of active management of the product selection and production process by the firm. A brief conclusion summarises the results of the analysis and highlights certain other practical implications for decision makers.

2. The basic deterministic framework

The standard familiar deterministic case is easily summarised, and with minor inconsequential variations can be depicted as follows. Consider a firm whose short-run productive capabilities depend upon the presence of a specific factor of production. In the current context this factor is represented by a machine with a known total productive capacity defined in terms of total machine hours for which the machine can be operated, denoted TMH. (All notation is defined in Exhibit 1.) Once utilised, a machine hour cannot be recovered through maintenance, or alternatively, a machine hour is measured net of any required maintenance activity. The machine is used by the firm in the production of *n* products.

We motivate the problem in the customary fashion adopted in the literature when considering a limiting factor allocation problem. This assumes that over the relevant decision horizon, the productive capacity of the machine is limiting in the sense that the firm is unable to manufacture all its products in the quantities required to satisfy its profitable customer orders in any given time period. Alternatively stated,

$$\sum_{i=1}^{n} TH_i > TMH.$$

The limiting factor allocation decision rules we develop are sufficiently flexible to be relevant to the entire range of demand environments and market structures in which firm's operate. As such, these desired production quantities can be taken to be exogenously determined by the impact of product market demand conditions and/or as the outcome of strategic decision-making, for example a desire to maintain market share. Such situations are discussed extensively in the industrial organisation and strategic management literature.[5]

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[5] Illustrative sources include Tirole (1990) and Trigeorgis (1996).

In the standard deterministic case, the price and production cost for all products are both known and also remain constant throughout the relevant decision period. Clearly, delaying production of any product until time $t=T$, even if feasible, results in a loss $(P_i - C_i)(1 - e^{-rT})$ per unit. Delaying production is, therefore, never optimal, and the option to wait has no value in this simple deterministic environment.[6]

Given the capacity constraints identified above, the optimal decision rule that efficiently allocates the limited resource (machine hours) across each product so as to maximise the firm's profit (earnings) is well known, and given by the solution to the following linear programming problem.

Find the H_i to maximise:

$$TE = \sum_{i=1}^{n} E_i = \sum_{i=1}^{n} W_i H_i \qquad (1)$$

Subject to the following constraints:

$$TH_i \geq H_i \geq 0,\ i=1,\ldots,n \text{ and } \sum_{i=1}^{n} H_i \leq TMH \qquad (2)$$

The constraints state: (i) that we should not allocate more than TH_i hours to any product; (ii) that the hours of production should not take negative values; and finally (iii) that the total hours of production should not exceed the total available machine hours. The solution to this problem results in the familiar optimal decision rule for efficiently allocating a limiting factor in a deterministic production and market environment. This rule ranks products according to their contribution per unit of limiting factor, W_i. The product with the highest Wi receives the initial allocation, and the factor is then sequentially allocated to each product according to its ranking until the limiting factor's capacity is exhausted.[7] Effectively, the rule maximises the profit arising from each hour of machine use, thereby maximising total profits.

3. Incorporating production flexibility and profit uncertainty

We now extend the results of the basic deterministic model outlined above, by introducing flexibility in the timing of production and uncertainty into the firm's profit (earnings) stream over time. Importantly, both conditions are necessary to induce any significant changes in the deterministic decision rule presented in Section 2. Introducing flexibility without uncertainty is either redundant, or can easily be handled by standard present value decision rules (see footnote 6). By imposing uncertainty without flexibility, which implies production is a 'now-or-never' decision, the problem collapses to a simple ranking of expected (risk-adjusted) contributions per unit of the limiting factor.

To emphasise the underlying intuition and clarify the logic underpinning the decision making process, the analysis extends the deterministic model in the simplest possible way to enable it to accommodate both production flexibility and profit uncertainty. Initially, consider production flexibility. We analyse a firm which produces only two products, denoted i = A,B.[8] The simplest way to accommodate meaningful production flexibility in the formulation of the limiting factor decision rule is to allow production of either product, or both products, to be undertaken at only two points in time, the present t=0, and a specific future point in time t=T. Management chooses the production strategy which maximises the present value of the firms profits. The significance of having only two possible specific times (t=0,T) at which production of both products may occur is that it enables the decision rule problem to be formulated as a real European option. The interval [0,T] is referred to as the deferral period.[9] The length of the deferral period (in real time) will vary across firms depending upon the relevant product market. In general, it is perhaps best interpreted as the time horizon over which the management has confidence in the stability of their forecasts relating to the evolution of both product market demand conditions and production costs, and within which they will not revise such estimates for planning purposes.

Although the firm can produce each product at both time 0 and time T, its total cumulative productive capacity is constrained by the availability of the limiting factor (total machine hours) which remains in fixed supply over the entire deferral period.[10] Thus, while all units of the limiting factor are accessible at t=0, only the remaining limiting factor capacity which has not been allocated to production at t=0 is available to be utilised at t=T. Any output produced at t=0 is contracted to be sold at the known product prices for A and B prevailing in the market at this time. As such, given t=0 costs are also known, the profits accruing to the firm from time 0 production are known with certainty.

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[6] Throughout, this paper adopts exponential compounding/discounting in accordance with the customary practice of the real options literature (Trigeorgis, 1996). The riskless interest rate, r, is to be interpreted accordingly. Note that if future prices/costs (t=T) are known with certainty, but not equal to present (t=0) prices/costs (i.e. they are not constant but still deterministic), the analysis of the limiting factor allocation proceeds as in the paper, with the (trivial) qualification that the best time to produce is now decided by comparing the present value of the future (t=T) profit stream with that from commencing production immediately.

[7] See the references in footnote 1 for further details.

[8] Section B in the Appendix to the paper provides a formal generalisation of the analysis to the case of *n* products.

[9] In Section C of the Appendix we analyse the continuous production case. Here, it is possible to start production of any product at any time instant during the deferral period [0,T] rather than simply at its beginning and/or its end. We demonstrate that the derivation of the decision rule in this scenario, which is equivalent to a real American option, is somewhat more complicated compared to the real European option analysed in the text. This is because the model now necessarily incorporates certain non-linearities, and the precise valuation results obtained depend upon the particular 'exercise' or production strategy selected by the firm. However, all the decision rules we derive in the text remain completely valid in the case of these real American options.

In contrast, any decision taken at t=0 to either fully or partially defer production of one or both products to t=T constitutes a conscious decision to expose the firm's profit stream to uncertainty. This is the second necessary condition whose presence motivates the amendment of the deterministic decision rule which is undertaken in this paper. Such uncertainty arises as output deferred until time T is produced on the basis of time T unit costs and is contracted to be sold at the product prices prevailing in the market at T. As viewed from time 0, the actual parameter values of time T prices and/or costs are unknown. However, in formulating any decision to defer production, the firm will take into account the expected fluctuations in its profits which arise from the impact upon revenues of those processes which it believes governs the evolution of the product price and cost parameters over the deferral horizon. The precise nature of these well-defined (stochastic) processes which are used to capture the variation in the price and cost parameters are described when considering the examples in Section 3.

In general, introducing uncertainty into the future profit stream of the firm can be achieved by making the revenues and/or cost of either or both of the two products stochastic. To clarify the intuition behind the derivation of the decision rule, uncertainty in the firm's revenues is introduced in the simplest possible way. Specifically, the market price of only one product, A is allowed to fluctuate during the deferral period [0,T]. At T, the decision by the firm regarding its time T overall production strategy is taken after the time T price of A has been revealed. Introducing cost as well as revenue uncertainty at this initial stage of the analysis only serves to complicate the exposition without yielding any further analytical insights. However, as we demonstrate in Section 4, the decision rule we develop is completely robust to making all product revenues and costs stochastic.[11] The extension to n periods, which involves evaluating the option to defer as an American rather than a European option is provided in Section C of the Appendix to the paper.

The limiting factor decision rule derived in this paper applies equally to all sources of earnings uncertainty. It provides the solution to the following interrelated problems which must be resolved by the firm at t = 0. Confronted with uncertainty in revenues and/or costs, and an ability to defer production, should the firm wait until time t = T to initiate production of either or both products, or should it fully or even partially produce some goods immediately, at t = 0?[12] In conjunction with this decision concerning the timing of production, how should the firm allocate the limiting factor across products?[13]

3.1. The revised decision-making process

Given the uncertainty surrounding product A's selling price, the ability to wait and delay full production of A to a future point in time creates an option value to the firm. In particular, it has been demonstrated that the value of waiting in the pres-

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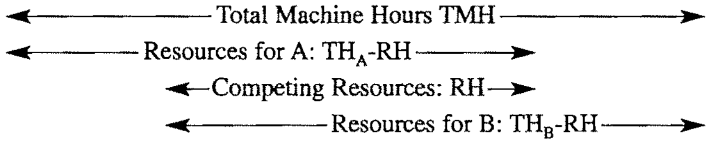
[10] The analysis can easily be extended to accommodate considerations such as depreciation or maintenance by allowing costs to follow a specified trend. Consideration of these issues at this stage would only distract us from the purpose at hand. However, example 4.3 contains further discussion of stochastic costs. Some of these cost fluctuations may be attributed to depreciation or maintenance.

[11] The rule is also completely robust to the source of revenue uncertainty, which is whether it is fluctuations in prices, in demand per period, or a joint fluctuation in both variables that generate stochastic revenues. In the latter case, the modelling issue is slightly more complex as it requires specification of the joint distribution of price and demand fluctuations and the resulting impact on the firm's net revenues.

[12] At this stage, it is perhaps worthwhile clarifying some issues concerning product demand. Clearly, any profit maximising decision to delay production of a product from 0 to T may leave some time 0 demand for this particular product unsatisfied. This is unavoidable and is essentially no different from a firm leaving demand unsatisfied because, say its optimal level of inventory is below maximum potential sales capacity. These customers either buy a substitute product elsewhere, are put on a waiting list and return later (at time T) to purchase, or go without the product. Clearly, the inability (or conscious decision not) to satisfy all time 0 demand could lead to future revenue loss through loss of goodwill. However, this is simply one factor underpinning the demand shifts which ultimately drive the stochastic processes governing price changes and is completely accommodated by the present analysis. If the (goodwill) revenue losses adversely affect future profits, then the firm will rationally make the decision not to delay production. Explicitly modelling the arrival of demand as a continuous flow, rather than as an available stock of customers to be contracted with upon the completion of production at time 0 or T is undertaken by the analysis in the Appendix. It is subject to the same caveats which apply to modelling the continuous production case to which we refer in footnote (9). However, once again we emphasise that all the limiting factor decision rules derived in the paper apply equally to this continuous flow demand situation.

[13] The decision rule we formulate also encompasses the situation where it is optimal for the firm to undertake an action at time t=T which it did not expect to be taking when it originally made the decision at t=0. Indeed, this is one of the strengths of the rule which emerges from this analysis. For example, on the basis of earnings information available at time t=0, the firm may decide it is optimal to postpone some production of product A, with the *expectation* of completing production of A at time T. However, at time T, following the resolution of uncertainty with respect to time T earnings from producing A, the firm may decide to switch productive capacity to product B, or may even abandon production altogether.

Figure 1
The nature of the competing resource



ence of price changes can be evaluated as a real (European) call option.[14] The issue is to discover the process whereby this option value is optimally incorporated into the decision rule, and to determine if the resulting rule differs meaningfully from that obtained under certainty. We now proceed to outline the logic underpinning the optimal decision rule.

The fact that

$$\sum_{i=A,B} TH_i - TMH = RH > 0$$

implies we have a deficit of RH hours of machine capacity relative to the hours required in order to be able to fully satisfy the firm's desired total production of both products. This is the essence of the limiting factor problem. This quantity of RH hours has a clear economic interpretation, which can be clarified by reference to Figure 1. These RH hours constitute what this paper defines as the competing resource. Allocation of these hours to production of one product (i = A,B) at either time t=0 or T, enables the firm to fully produce the selected product by the end of the flexible production period, in the total quantity demanded to maximise its profits.[15] However, the firm's decision to allocate the competing resource to one of the products involves a simultaneous commitment to only partially satisfy the market demand for the remaining product ($j = A,B, j \neq i$).

Independently of how we decide to allocate the hours of competing resource, we still have available ($TH_A - RH$) hours to allocate to the production of A, and ($TH_B - RH$) hours to allocate to B. There is no competition between products for the use of these remaining hours. Flexibility dictates that the production of each product, A and B, can occur either at time t=0 or at t=T. The decision involved in allocating these hours reduces to deciding upon the optimal time at which any desired production should occur. It is completely independent of any decisions made with respect to allocation of the competing resource. For each product, the allocation decision involves comparing the value of producing at t=0 with the option value of waiting to produce at t=T. This comparison involves two mutually exclusive alternatives, produce product i at time t=0 or defer the decision to produce until t=T, which as stated earlier is a European type of option. The discussion to date maintains that the limiting factor allocation decision can be broken down into three independent stages:

D1: Decide upon the optimal use of ($TH_A - RH$) hours in the production of *A*

D2: Decide upon the optimal use of ($TH_B - RH$) hours in the production of *B*

D3: Decide upon the optimal use of *RH* hours in the production of either A or B

A formal proof, using linear programming analysis, which demonstrates that this indeed constitutes the optimal decision rule, is provided in Section A of the Appendix. We now provide intuition on the logic underpinning this rule in somewhat more detail.

3.2. The optimal decision-making rule

Consider the simple production environment, in which only the price of one product (say) A is stochastic, and the price of the other product B is constant between t and T. This implies $e^{-rT}E_{t=0}[\max\{W_B(T),0\}] < W_B(0)$, so that it is always optimal to produce some B at t=0 rather than defer its full production until t=T. It is important to stress that the validity of the ensuing logic underpinning the derivation of the optimal decision rule in no way depends upon this simple scenario, which is assumed purely for expositional purposes. The ensuing argument is perfectly general in its applicability, and section A of the Appendix presents a rigorous generalisation of the resulting decision rule entailed by a more complex production environment.

Introducing uncertainty in the price of the product A generates five possible alternative, mutually exclusive, production scenarios. These are illustrated in Figure 2. Note, that the analysis also allows for the possibility that $W_A(T)$ can become

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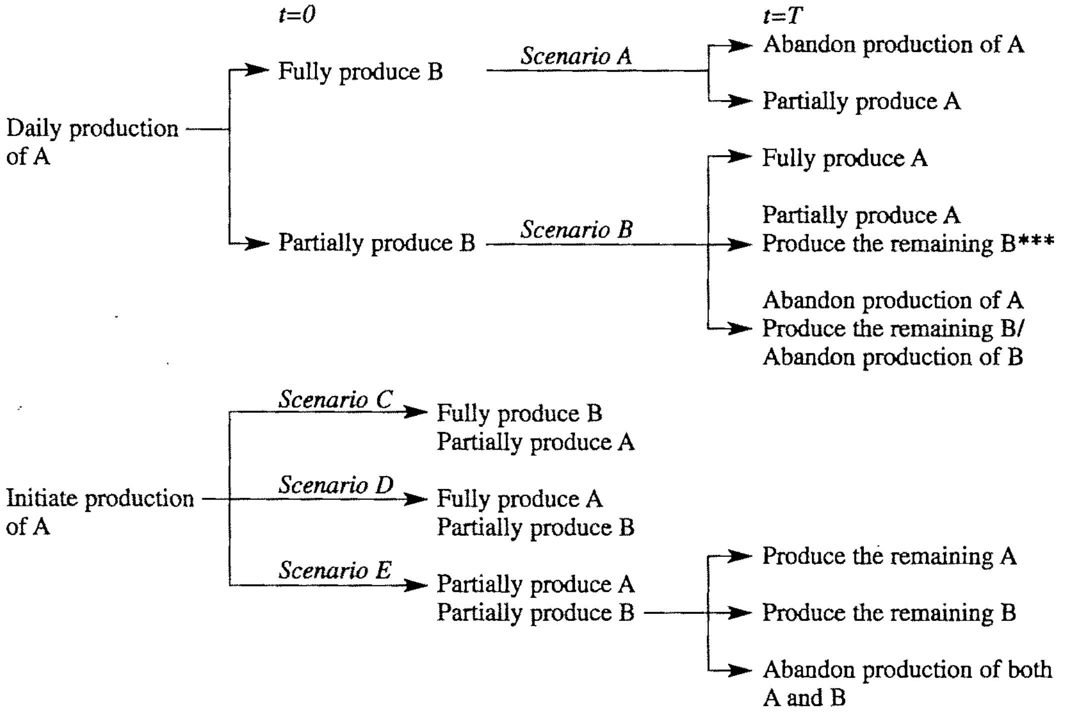
[14] There is an extensive literature documenting the parallel between price changes and call options and cost of production changes and put options in determining firm value, for example, Trigeorgis (1996) or Copeland and Antikarov (2001).

[15] In Section A of the Appendix we demonstrate that the relationship illustrated, $TMH > TH_i$ (i = A,B) represents the most general case. The Appendix also considers all the other possible cases, namely: $TH_i \geq$, $TMH \geq TH_j$ ($i = A,B; i \neq j$); $TMH < THi$ (i = A,B). These cases also require slight modification to the definition of the competing resource.

Figure 2
Alternative production strategies available to the firm at t=0 and t=T



***You cannot decide not to produce product B while you are partially producing A, because that would mean you should in fact be fully producing product A.

negative, in which case the choice is simply to abandon A's production at t=T.[16]

Derivation of the decision rule requires that for each production scenario, we compute the present value of the firm's earnings (profits) at t=T. By assuming that the production manager selects the production strategy that yields the maximum present value of earnings (profits) for the firm, we obtain a decision rule which results in the 'optimum' production plan. Before deriving the optimum production plan, a summary of the present value of earnings under each possible scenario is presented. This taxonomy is split into two categories. The first two scenarios (S1 and S2) involve no production of A at time t=0, while the latter three (S3-S5) all involve some production of A at t=0. Note, that for the reasons given above, all five scenarios all involve *at least* partial production of the deterministic product B at *t=0*, using the $(TH_B - RH)$ hours which are available for this purpose.

Scenario S1

This corresponds to full production of B in the desired quantity at time t=0, combined with postponement of the decision as to whether or not produce any A until t=T. The partial earnings under this scenario at *t=T*, arising from the option to produce A at this time, are given by:

$$PE_A(T) = (TH_A - RH)\max\{W_A(T),0\}$$

Therefore, the present value of earnings under this scenario are:

$$PV_A = TH_B W_B(0) + e^{-rT}(TH_A - RH)E_{t=0}\{\max[W_A(T),0]\} \tag{3}$$

The first term on the right-hand side of (3) is the value of the earnings from the decision to produce B at t=0, the second term is the t=0 value of the option to (partially) produce A at t=T.

Scenario S2

This arises when the firm partially produces the desired quantity of B at time t=0 using $(TH_B - RH)$ hours, and postpones the decision as to whether or not produce A and/or the remaining B until time t=T. The partial earnings under this scenario at *t=T* accrue from the option to produce A and/or the remaining B at this time and are given by:

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[16] We do not consider cases where early, pre-emptive entry into a market, even at a loss, might prove to be beneficial to the firm in the long-run.

Figure 3
The present values of the different possible production scenarios

		Hours	
Scenario	$(TH_B - RH)$	$(TH_A - RH)$	RH
S1	$W_B(0)$	$e^{-rT} E_{t=0}\{\max[W_A(T),0]\}$	$W_B(0)$
S2	$W_B(0)$	$e^{-rT} E_{t=0}\{\max[W_A(T),0]\}$	$e^{-rT} E_{t=0}\{\max[W_A(T),W_B(T),0]\}$
S3	$W_B(0)$	$W_A(0)$	$W_B(0)$
S4	$W_B(0)$	$W_A(0)$	$W_A(0)$
S5	$W_B(0)$	$W_A(0)$	$e^{-rT} E_{t=0}\{\max[W_A(T),W_B(T),0]\}$

$$PE_B(T) = RH\max\{W_A(T),W_B(T),0\} +$$
$$(TH_A - RH)\max\{W_A(T),0\}$$

Therefore, the present value of earnings under this scenario is:

$$PV_B = (TH_B - RH)W_B(0) + \qquad (4)$$
$$e^{-rT}\{RH\,E_{t=0}[\max\{W_A(T),W_B(T),0\}] +$$
$$(TH_A - RH)E_{t=0}[\max\{W_A(T),0\}]\}$$

The first term on the right-hand side of (4) is the value of the earnings from the decision to partially produce B at t=0, the second is the t=0 value of the option to wait until t=T to select the earnings maximising production strategy, the third is again the t=0 value of the option to (partially) produce A at t=T. These strategies are indicated in Figure 2.

Scenario S3
This encompasses full production of product B and partial production of A at t=0. There is no production at t=T. The value of the earnings generated by the firm from this scenario is:

$$PV_C = TH_B W_B(0) + (TH_A - RH)W_A(0) \qquad (5)$$

Scenario S4
This represents what is in effect the analogue to S3, with full production of product A and partial production of B occurring at t=0. The value of the firm's earnings in this case is:

$$PV_D = TH_A W_A(0) + (TH_B - RH)W_B(0) \qquad (6)$$

Scenario S5
The final situation occurs when the firm decides to partially produce both A and B at t=0, using $(TH_A - RH)$ hours for A and $(TH_B - RH)$ hours for B. The firm takes advantage of the option to wait until t=T when it will decide how to allocate the remaining RH hours to either product A or B. It may even abandon production altogether, depending upon the situation at that time. The partial earnings generated by the scenario at t=T are given by:

$$PE_E(T) = RH\max\{W_A(T),W_B(T),0\}$$

The present value of the firm's earnings for this scenario is:

$$PV_E = (TH_A - RH)W_A(0) + \qquad (7)$$
$$(TH_B - RH)W_B(0) +$$
$$e^{-rT} RH\,E_{t=0}[\max\{W_A(T),W_B(T)\},0]$$

This taxonomy of the mutually exclusive (and exhaustive) production schedules for allocating the limiting factor clarifies understanding of how the decision should be made. The firm selects its production strategy by choosing to implement the scenario with the greatest present value ($\max[PV_{S1},PV_{S2},PV_{S3},PV_{S4},PV_{S5}]$). In Figure 3 we present the present value of each scenario, given by equations (3)–(7), in a way that facilitates comparison and thereby clarifies how the optimum production plan is selected.

From Figure 3 it becomes immediately apparent by comparing entries in the appropriate column, that in order to allocate the $(TH_A - RH)$ hours we choose the $\max[e^{-rT} E_{t=0}\{\max[W_A(T),0]\},W_A(0)]$. The decision with regard to the competing resource, *RH* hours, is marginally more complex. It involves deciding whether these resources should be committed to either product A or B at t=0, in which case the earnings would be RH.$\max\{W_A(0),W_B(0)\}$, or waiting until t=T when the firm will choose either to produce the product which will contribute most to its earnings or abandon production altogether, according to e^{-rT} *RH* $E_{t=0}[\max\{W_A(T),W_B(T)\},0]$. Combining the two temporal decisions implies the firm selects:

$$\max[e^{-rT} E_{t=0}\{\max[W_A(T),W_B(T),0]\},W_A(0),W_B(0)] \qquad (8)$$

In the introduction we referred to the notion of using one product as the supporter. This is a production strategy which effectively generates insurance for the firm whenever a previous decision to defer production of a given product(s) turns out to be of limited value, or even worthless. Alternatively stated, production of the supporter is the fall-back position when an option to defer production ends up being insufficiently 'in-the-money', or even 'out-of-the-money'. In this particular example, we use product *B* as a supporter to diversify the production earnings risk, as it is apparent that $e^{-rT} E_{t=0}\{\max[W_A(T), W_B(T), 0]\} \geq e^{-rT} E_{t=0}\{\max[W_A(T), 0]\}$.[17] A further illustration of the role of the supporter is provided in example 4.2 below.

Reference to Figure 3 and the previous discussion indicates that the limiting factor allocation decision can be split into the three independent stages, D1–D3 specified above, namely:

D1: Decide upon the optimal use of $(TH_A - RH)$ hours in the production of A

D2: Decide upon the optimal use of $(TH_B - RH)$ hours in the production of B

D3: Decide upon the optimal use of *RH* hours in the production of either A or B

3.3. All prices stochastic: a formal statement of the generalised decision rule

We now relax the assumption that only the price (revenue) of product A is stochastic. The importance of the result that the limiting factor allocation decision can always be separated into the three distinct and independent decisions, D1–D3 now becomes apparent. Specifically, it allows us to derive the decision rule for the case of both product prices (revenue streams) being stochastic by drawing a simple analogy with the previous section. In terms of the underlying decision making process, the only significant impact is upon D2, the optimal use of $(TH_B - RH)$ hours in the production of *B*. In effect, we now treat product B in identical fashion to how we previously dealt with product A, noting that it is no longer true that it is always appropriate to produce some B at t=0. Instead, in deciding how to allocate the $(TH_B - RH)$ hours, the firm selects the $\max[e^{-rT} E_{t=0}\{\max[W_B(T), 0]\}, W_B(0)]$. On this basis, the full decision rule with all prices (earnings) stochastic can be represented as follows.

D1: Depending upon how $e^{-rT} E_{t=0}\{\max[W_A(T), 0]\}$ compares with $W_A(0)$, the decision maker decides how to use the available $(TH_A - R_H)$ hours.

D2: Depending upon how $e^{-rT} E_{t=0}\{\max[W_B(T), 0]\}$ compares with $W_B(0)$, the decision maker decides how to use the available $(TH_B - R_H)$ hours.

D3: Depending upon how $e^{-rT} E_{t=0}\{\max\ [W_A(T), W_B(T), 0]\}$ compares with $\max\{W_A(0), W_B(0)\}$, the decision maker decides how to use the *RH* hours of available competing resource.

To clarify the operation of this rule, the following two sections consider a series of illustrative numerical examples. The examples are selected to indicate those central features of the analysis that are not apparent when analysing a deterministic environment. In all the examples presented the prices of both products are stochastic. The examples 4.1 present the benchmark case, and emphasise the role of intra-product flexibility. The introduction of both positive and negative correlation between product price movements in example 4.2, illustrates the role of the supporter, and also the importance of maintaining inter-product production flexibility in an environment characterised by uncertainty. This is a critical, but sometimes neglected source of production flexibility to the firm. The final set of examples 4.3 demonstrates that the analytical framework can also accommodate stochastic costs, and extends the analysis of the supporter and inter-product flexibility to this more general environment.

4. Numerical illustrations of the decision rule

To illustrate the practical operation of the decision rule we consider a situation where the prices of each product, P_i, i = A,B each follow a lognormal stochastic process, albeit each of these processes has different parameters. This process is selected as it is the most common price generating process in the literature, familiar to those acquainted with financial options (see Hull, 2000 and Wilmott, 1999). More precisely, the product prices are each assumed to follow a continuous stochastic process:

$$\frac{dP_i}{P_i} = \mu_i dt + \sigma_i dz_i, \quad i=\{A,B\} \tag{9}$$

where μ_i is the expected growth rate of the output price per annum, σ_i is the volatility per annum and dz_i is the random increment to the Wiener process z_i. All the ensuing numerical calculations employ Monte-Carlo simulation using the antithetic variable technique to reduce the variance, and the results are presented together with the standard error of the estimate in parenthesis. The standard error is estimated from the sample standard deviation of the n averaged points (or number of simulation trials) used. It is worth noting that since we allow for $\mu_i \neq r$ (the interest rate), all the following examples of European options used to illustrate the produc-

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[17] For a formal proof see case A in Section A of the Appendix.

Table 1a
Parameter values for examples 4.1a and 4.2

	Parameters					
Product	μ	σ	*MH (hours/unit)*	*P(0) (€/unit)*	*C(0) (€/unit)*	*TH hours*
A	0.2	0.12	0.5	70	50	70
B	0.02	0.12	1	90	60	80

tion deferral decision can also accommodate what the real options literature terms 'dividend like effects'. These are simply any (net) costs associated with the deferral of production, for example, depreciation costs or costs associated with mothballing plant or equipment. Unless otherwise stated, the simulations assume that the value of the parameters is as follows: total machine hours, *TMH*, are equal to 110; the risk free interest rate is 10% per annum; and production can only occur either at t=0 (immediately) or at T=0.5 (in six months). Per unit production costs are given in the appropriate accompanying Tables.

4.1. The real option benchmarks and intra-product flexibility examples

The parameter values for the initial example 4.1a are presented in Table 1a. All notation is defined either in Exhibit 1 or in the previous section. To provide a benchmark, note that in the absence of uncertainty, the standard management accounting approach allocates the limiting factor (machine hours) across products according to a products contribution to profit per unit of limiting factor, W_i. The resulting factor allocation and profit contribution for each product this standard allocation rule generates with the given parameter values are:

$$W_A(0) = \frac{P_A(0) - C_A(0)}{MH_A} = 40 \text{ €/}hour$$

$$W_B(0) = \frac{P_B(0) - C_B(0)}{MH_B} = 30 \text{ €/}hour$$

Consequently, in this deterministic environment the firm would allocate 70 hours to product A and 40 hours to product B, and the contribution of this decision to the firm's profit is 4000€. We now turn to consider the effects of introducing stochastic prices, and clarify the circumstances in which utilising a real option approach to decision making, rather than simply modifying more traditional limiting factor approaches (for example, by replacing actual with expected values) is likely to make a significant difference to managerial decisions, and consequently to a firm's profitability.

The initial example 4.1a, presents a situation in which that the stochastic processes driving the prices of the two products A, B are independent (uncorrelated), so that on average price increases in product A correspond neither to price increases or decreases in product B. However, expected price increases in product A far exceed those in product B, although both products exhibit the same price volatility. Results from Monte Carlo simulations of *n* potential price paths (with *n*=100000), generate values of the option to defer production for each product (per unit of the limiting factor), and for the competing resource hours, with 95% confidence, to be:

(i) $e^{-rT} E_{t=0} \{\max[W_A(T),0]\} = 52.08$ ± 0.08 €/*hour* (standard error 0.03)

(ii) $e^{-rT} E_{t=0} \{\max[W_B(T),0]\} = 28.40$ ± 0.05 €/*hour* (standard error 0.02)

(iii) $e^{-rT} E_{t=0} \{\max[W_A(T),W_B(T),0]\} = 52.40$ ± 0.08 €/*hour* (standard error 0.03)

Relating these values to the generalised decision rule derived in Section 3.2 results in the following optimal production strategy.

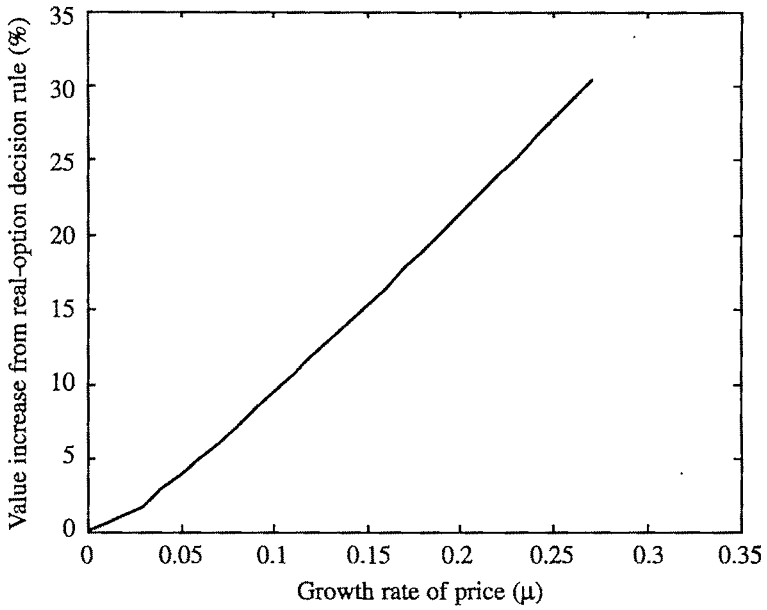
D1: As $e^{-rT} E_{t=0} \{\max[W_A(T),0]\} > W_A(0)$, (52.08 > 40), the firm should allocate $(TH_A - RH) =$ 30 hours to the production of A, but defer its production until t=T.

D2: As $e^{-rT} E_{t=0} \{\max[W_B(T),0]\} < W_B(0)$, (28.40 < 30) the firm should allocate $(TH_B - RH) =$ 40 hours to the immediate production of B at t=0.

D3: As $e^{-rT} E_{t=0} \{\max[W_A(T),W_B(T),0]\} > \max\{W_A(0),W_B,0]\}$, (52.40 > 40) the firm should wait until t=T (six months) before deciding how to allocate the remaining *RH* = 40 hours of competing resource. At T, the firm will produce the most profitable product, or not produce at all if production of both products is revealed to be unprofitable.

The present value of the real option valuation of the decision to the firm is (30 x 52.08) + (40 x 30) + (40 x 52.40) = 4858.4€. This represents a significant 21.46% increase above the 4000€ which is the benchmark present value estimate obtained from the standard decision rule. Before proceeding, it is appropriate to spend sometime discussing

Figure 4
The impact on firm value of changing the growth rate of the price of product A



Note: Other parameter values for the simulation are given in Table 1a.

the reasons for this significant increase in firm valuation from application of the generalised decision rule proposed in this paper.[18] This is a worthwhile exercise, as it will enable the analysis to highlight the circumstances in which the managerial benefits to using the real option based rules are most likely to outweigh the greater information and communication costs the rule entails.

As indicated in Section 3.1, the returns to the firm attributable to production flexibility in the presence of stochastic product prices can be evaluated as a real call option (Trigeorgis, 1996). Thus, the changes in the firm's market and operating environment which have the greatest potential to positively impact upon the value of this real call option are also the factors which (*ceteris paribus*) will generate the greatest benefits to managers from using the options-based decision rules rather than relying on traditional deterministic methods of allocating the limiting factor. It follows from the real options literature that using the real option based decision rules in the presence of stochastic prices, is likely to yield the greatest benefits to the firm: (i) the greater the potential for future price growth (higher μ); (ii) the greater the uncertainty attached to the future revenue stream (greater σ); (iii) the greater T, the length of the period over which production is flexible, and (iv) the greater the interest rate, *r*: a higher *r* reduces the present value of the real option exercise price, although we note that in practice changes in firm value with respect to changes in *r* will be fairly minimal over commonly observed vales of the interest rate. In most practical applications, factors (i) and (ii) are likely to dominate and provide the focus for the present examples. Specifically, with reference to (i), Figure 4 illustrates the sensitivity of firm value changes from using the real option based decision rule (relative to the benchmark deterministic rule valuation) in the presence of changing levels of μ, the growth rate of product A's price. The parameter values used in the simulation are given in Table 1a. The increase in firm value obtained in example 4.1a by using the real option based rules is immediately apparent by setting $\mu = 0.2$ on the horizontal axis of Figure 4.

The importance of factor (ii), uncertainty in future revenue streams is the subject of the next example, 4.1b. The parameter values in example 4.1b are identical to those utilised in 4.1a except for the postulated increase in the price volatility of product B from 12% to 50%. As discussed above, option pricing theory tells us that this amendment will not only increase the real option value of deferring production of product B, but will also result in an increased valuation of the firm. Our decision rule enables us to quantify this impact upon the firm's profitability.

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[18] We would like to acknowledge the comments of the editor and an anonymous referee which motivated the ensuing discussion in this section.

Table 1b
Parameter values for example 4.1b

	Parameters					
Product	μ	σ	*MH (hours/unit)*	*P(0) (€/unit)*	*C(0) (€/unit)*	*TH hours*
A	0.2	0.12	0.5	70	50	70
B	0.02	0.5	1	90	60	80

If the stochastic processes driving the prices of the two products A, B remain independent, Monte Carlo simulations of n potential price paths (with n=100000), generate values of the option to defer production for each product (per unit of the limiting factor), and for the competing resource hours, with 95% confidence, to be:

(i) $e^{-rT} E_{t=0} \{\max[W_A(T),0]\} = 52.08$ ± 0.08 *€/hour* (standard error 0.03)

(ii) $e^{-rT} E_{t=0} \{\max[W_B(T),0]\} = 30.90$ ± 0.08 *€/hour* (standard error 0.04)

(iii) $e^{-rT} E_{t=0} \{\max[W_A(T), W_B(T),0]\} = 57.90$ ± 0.07 *€/hour* (standard error 0.03)

Applying the generalised decision rule derived in Section 3.2 now yields the following optimal production strategy.

D1: As $e^{-rT} E_{t=0} \{\max[W_A(T),0]\} > W_A(0)$, (52.08 > 40), the firm should allocate $(TH_A - RH)$ = 30 hours to the production of A, but defer any production until t=T.

D2: As $e^{-rT} E_{t=0} \{\max[W_B(T),0]\} > W_B(0)$, (30.90 > 30) the firm should allocate $(TH_B - RH)$ = 40 hours to the production of B, and also defer any production until t=T.

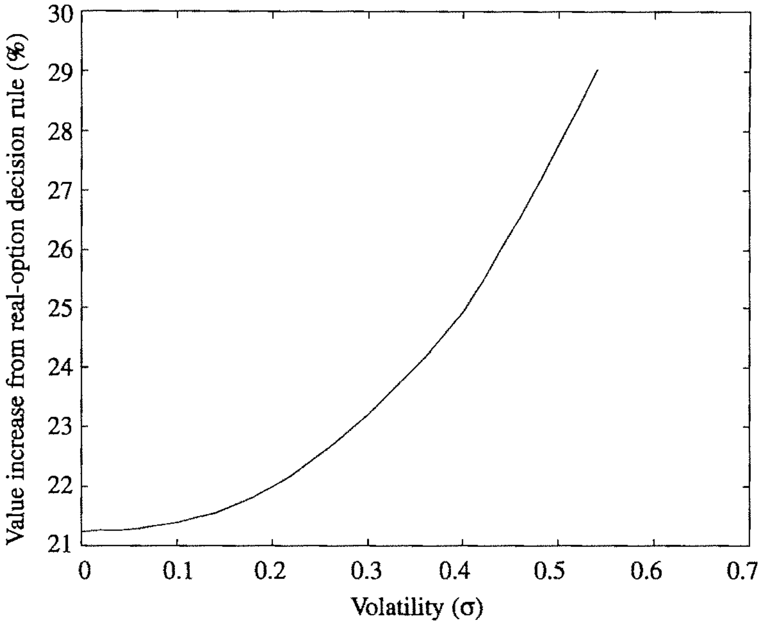
D3: As $e^{-rT} E_{t=0} \{\max[W_A(T), W_B(T),0]\} > \max\{W_A(0), W_B, 0]\}$, (57.90 > 40) the firm should wait until t=T (six months) before deciding how to allocate the remaining RH = 40 hours of competing resource. At T, the firm either produces the most profitable product, or does not produce at all if both products have become unprofitable.

The present value of the real option valuation of the decision to the firm is (30 x 52.08) + (40 x 30) + (40 x 57.90) = 5115€. Not only is this a significant 27.88% enhancement above the 4000€ benchmark present value estimate obtained from the standard decision rule, but also the rise in price volatility of product B from 12% (in example 4.1a) to 50% (in this example 4.1b) has generated a 6.42% increase in the present value of the real option valuation. The sensitivity of the firm's overall valuation to changes in the price volatility of product B, σ, once more measured relative to the benchmark value given by the deterministic rule, is illustrated in Figure 5.

Indeed, upon applying D2, it is apparent that the volatility induced increase in option value of waiting in example 4.1b has become sufficiently large that it now no longer pays the firm to produce any B at time 0; the likelihood is delaying production to T will be more profitable. This feature is an illustration of the value of intra-product flexibility. This is the value associated with the ability of the firm to vary the time at which the limiting factor is dedicated to the production of a specific product, in this case product B, depending upon the resolution of uncertainty over the deferral period. As the option value of waiting to produce any one of its products increases, so will the value of intra-product flexibility to the firm. Moreover, application of the real option decision rule enables the firm to quantify the contribution of intra-product flexibility to its overall profitability. A second enhancement to firm valuation arises from the increase in the option value of delaying, until time T, the decision regarding the optimal allocation of the competing resource, represented by D3.

This situation in example 4.1b is also revealing in another important context. Faced with uncertainty, a decision-maker may be tempted to reach a decision by a straightforward, intuitive reformulation of the standard deterministic decision rule, namely replacing the actual values of stochastic variables with their expected values. In this case, this amounts to replacing the selling price for the products with the t=0 value of their expected selling price (or the expected contribution to profit obtained from this expected price). The resulting expected contribution per unit of limiting factor could then be used as the basis upon which to make the decision at t=0. As the reader can easily confirm, because the expected increase in the selling price for product B is below the risk-free interest rate, a decision reached on this basis suggests the firm should not wait until t=T before allocating the 40 hours of resource to the production of B, but should produce immediately at t=0. This method of reaching a decision yields the equivalent factor allocation as that based on the contribution per unit of limiting factor in a world of certainty. By ignoring the real option value, such a straightforward

Figure 5
The impact on firm value of changing the price volatility of product B



Note: Other parameter values for the simulation are given in Table 1a.

extension of the deterministic rule is an incorrect manner in which to proceed. The reason is that such a procedure effectively ignores the added value the firm generates from more proactive management of the production process.

4.2. Inter-product flexibility example

The objective of the following example 4.2 is to analyse the effect on decision making of introducing a non-zero correlation between the two Wiener processes governing the evolution of the two stochastic product prices through time. The example adopts the identical parameter values to those in Table 1a, but now incorporates a correlation of $\rho = \pm 0.5$ between the two Wiener processes. A positive (negative) correlation simply implies that, on average, an increase in the price of one product is accompanied by a price increase (decrease) in the other product. Once again, Monte Carlo simulations are used to calculate the value of each option, with n=100000, and 95% confidence.

Clearly, as resource allocation decisions are made independently for each product in the absence of a competing resource, any correlation between price generating processes is irrelevant for the value of decision rules D1 and D2. It follows that these option values (and associated decisions) will remain unchanged throughout the example at the values calculated previously in example 4.1a. The decision whose value is affected by the price correlation is that which relates to the value of the competing resource, D3. The value of the allocation decision with respect to the competing resource is now sensitive to the chosen value of ρ. In particular:

(iiia) $e^{-rT} E_{t=0} \{\max[W_A(T), W_B(T), 0]\} = 52.13 \pm 0.08$ €/*hour* (s.e. 0.04) for $\rho = +0.5$

(iiib) $e^{-rT} E_{t=0} \{\max[W_A(T), W_B(T), 0]\} = 52.80 \pm 0.07$ €/*hour* (s.e. 0.035) for $\rho = -0.5$

In this particular example, as $e^{-rT} E_{t=0} \{\max[W_A(T), W_B(T), 0]\} > \max\{W_A(0), W_B(0)\}$, for both positive and negative price correlations, the firm should always wait until time T before deciding how to allocate the RH = 40 hours of competing resource. This decision is simply a consequence of the parameter values chosen. However, the central message of this example is what it reveals in a qualitative sense. Specifically, note that the left hand side of the inequality, $e^{-rT} E_{t=0} \{\max[W_A(T), W_B(T), 0]\}$ in D3, takes its lowest option value in the case of a positive price correlation, $\rho = 0.5$ (iiia), and its highest option value when prices are negatively correlated, $\rho = -0.5$ (iiib) (recall the value with zero correlation is 52.40 €/*hour*).

The increase (decrease) in the present value of the decision rule D3[19] that arises in the presence of

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[19] The value of the decision to the firm with negative price correlation between products is €4,872.4, an increase of 21.81% relative to the benchmark case, and with positive price correlation is €4,847.6, an increase of 21.19%.

Table 2
Parameter values for example 4.3

	Parameters							
Product	μ	–	$–_c$	σ_c	*MH (hours/unit)*	*P(0) (€/unit)*	*C(0) (€/unit)*	*TH hours*
A	0.02	0.12	0.015	0.10	0.5	70	50	70
B	0.01	0.12	0.015	0.05	1	90	60	80

negative (positive) product price correlation is an important universal characteristic of the real option approach. Intuitively, the increase in firm value in the presence of negative price change correlation is attributable to the fact that in the event of a price reduction in one product, which in the present formulation is an adverse shock leading to a reduction in firm earnings, there is an enhanced probability that production can profitably be switched to another product whose price is likely to have moved favourably, thereby generating an offsetting increase in firm profits.[20]

The importance of such inter-product flexibility in the presence of negative price correlation illustrates another concept illuminated by the real option approach which is not evident in a deterministic setting. This is the use of products as supporters for one another. In effect, a supporter provides the multi-product firm with implicit insurance by enabling it to re-allocate productive capacity across products, and alter the composition of its final product mix, in response to revealed changes in profitability. In contrast, in the case of positive price correlation the product mix diversification benefits obtained from using the two products as supporters for each other is somewhat reduced. A fall in earnings from one product is now likely to be compounded further by a poor earnings performance in the other product. This phenomena of what may be termed systemic product-mix risk, accounts for the reduction in the value of the decision represented by D3 in the presence of positive price correlation. In the following section we extend the analysis to incorporate stochastic costs, and demonstrate that the above findings with respect to positive and negative correlation remain valid when generalised to this context.

4.3. *Stochastic prices and costs example*

The analysis now introduces variable costs. Two further lognormal stochastic processes are specified to govern the evolution of the production costs of both products A and B through time. In an analogous fashion to equation (9), the product prices are each assumed to follow the continuous stochastic process:

$$\frac{dC_i}{C_i} = \mu_{ci} dt + \sigma_{ci} dz_i\,, \quad i=\{A,B\} \tag{10}$$

where μ_{ci} is the expected growth rate of production costs (C_i) per annum, σ_{ci} is the volatility of costs per annum and dz_i is the random increment to the Wiener process z_i. Recall that in the presence of stochastic costs, ceteris paribus the value of waiting can be treated as a real put option. Thus, with both prices and costs stochastic the firm effectively holds a portfolio of real call and put options, and it is the value of this portfolio of real options which determines the optimal production schedule. Before proceeding, we note that interaction among real options present in a portfolio will generally results in an overall portfolio valuation which is not simply equivalent to the sum of the individual constituent options, valued in isolation.[21] Although a detailed discussion of the valuation of real option interactions is not the subject of this paper, the valuation impact of the option interactions has been shown to depend upon: the option type; the nature of the correlation between changes in the value of the underlying assets (here product prices and costs of production); and on the sequence in which the real options can be exercised (Trigeorgis, 1993). The following examples now clarify the impact of certain of these circumstances in greater detail.[22]

To facilitate comparison, the remaining examples utilise price and cost parameter values such that the decision rules D1–D3 generate real option values comparable to the values obtained in the deterministic benchmark model. These parameter values are presented in Table 2.

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[20] The analysis further discusses the valuation implications of option interaction in the context of the next set of examples 4.3.

[21] If the value of the real option portfolio is equal to the sum of the individual constituent option values, it exhibits the property known as additivity.

[22] The present analysis is not structured to be able to consider the impact of the timing of exercise of the real options. Following Trigeorgis (1993), it is sufficient to note that if a put (call) precedes a later call (put) option, the combined portfolio value will generally exhibit negative (positive) interaction of individual option values. This is known as sub-additivity (super-additivity) of option values. Exercising a series of calls sequentially also generally yields a positive interaction. For illustrations using option values from an actual project application, see Bowe and Lee (2004).

Initially, the examples 4.3 consider a situation where the stochastic processes driving the prices and costs of both the products A, B are completely independent (uncorrelated), so that on average price changes in product i correspond neither to own cost increases or decreases nor to price or cost changes in product j. Simulation of *n* potential price paths (with n=100000) using Monte Carlo methods generates values of the option to defer production of each product (per unit of the limiting factor), and also a value for the competing resource hours. With 95% confidence, these are found to be:

(i) $e^{-rT} E_{t=0}\{\max[W_A(T),0]\} = 38.72 \pm 0.06$ *€/hour*

(ii) $e^{-rT} E_{t=0}\{\max[W_B(T),0]\} = 28.56 \pm 0.04$ *€/hour*

(iii) $e^{-rT} E_{t=0}\{\max[W_A(T),W_B(T),0]\} = 41.00 \pm 0.05$ *€/hour*

Relating these values to the generalised decision rule derived in section 3.2 yields the following optimal production strategy:

D1: As $e^{-rT} E_{t=0}\{W_A(T),0]\} < W_A(0)$, (38.72 < 40), the firm should allocate $(TH_A - RH) = 30$ hours to the production of A at t=0.

D2: As $e^{-rT} E_{t=0}\{W_B(T),0]\} < W_B(0)$, (28.56 < 30) the firm should allocate $(TH_B - RH) = 40$ hours to the production of B at t=0.

D3: As $e^{-rT} E_{t=0}\{\max[W_A(T),W_B(T),0]\} > \max\{W_A(0),W_B,0]\}$, (41.00 > 40) the firm should optimally wait until t=T (six months) before deciding how to allocate the $RH = 40$ hours of competing resource. At T, the firm will produce the most profitable product, or not produce at all if production of both products is revealed to be unprofitable.

We now introduce price and cost correlation. Crucially, in all the examples to follow, the value of decisions D1 and D2 will be maintained to be the same as in the uncorrelated case above (example 4.3). It is then always optimal at t = 0 to produce both A and B using the $30 = (TH_A - RH)$ hours and $40 = (TH_B - RH)$ hours, respectively. This feature enables us to focus attention upon the central issue, namely the impact of the price/cost correlations on D3, the decision underpinning allocation of the competing resource.

4.3a. Own product price and cost correlation examples

Here, in the set of examples 4.3a, the initial assumption is that prices and cost movements in the same product may be correlated both positively, as is characteristic of a firm engaging in mark-up pricing, or negatively, such as the situation where a firm-specific cost reduction or productivity increase enhances a firm's market power and enables it to increase prices. All cross-product price-cost correlations remain at zero (uncorrelated). Three cases of potential interest are evaluated, differing simply in the patterns of price-cost correlation exhibited (the assumed value of the relevant correlation coefficient [ρ] is given in parenthesis). This number of cases is sufficient to indicate the general trends which emerge. In each case we also present the option value of waiting until t=T to determine how to allocate the competing resource, $e^{-rT} E_{t=0}\{\max[W_A(T),W_B(T),0]\}$, a crucial input into D3. The cases and ensuing value of waiting are as follows:

C1. P_A, C_A *positively correlated* ($\rho = 0.5$); P_B, C_B *negatively correlated* ($\rho = -0.5$)
Value of waiting = 40.33 ± 0.04 *€/hour*

C2. P_A, C_A *positively correlated* ($\rho = 0.5$); P_B, C_B *positively correlated* ($\rho = 0.5$)
Value of waiting = 39.93 ± 0.04 *€/hour*

C3. P_A, C_A *negatively correlated* ($\rho = -0.5$); P_B, C_B *negatively correlated* ($\rho = -0.5$)
Value of waiting = 41.92 ± 0.06 *€/hour*

These cases indicate that the option value of waiting is minimised under circumstances of positive correlation (C2) and enhanced when prices and costs are negatively correlated, C1 through to C3. Indeed, in case C2, the value of waiting 39.93 < 40, which is the value of allocating the 40 RH hours to the immediate production of product A at t = 0. Application of rule D3 indicates that the firm should use the 40 RH hours in the immediate (t=0) production of A. Intuitively, the reason is that in the presence of positive correlation, changes in prices and costs have a greater tendency to offset each other, on average, in their impact on the firm's profits. Profits then tend to exhibit less variability in the presence of uncertainty, and the value of waiting is consequently reduced. Whereas with negative correlation, not only are parameter changes reinforcing, so earnings exhibit higher volatility, but the value of inter-product flexibility obtained from using one product as the supporter, discussed in example 4.2, is enhanced. Thus, negative price-cost correlation will in general increase the option value of waiting to the firm, and it is in these circumstances that using the real option based decision rules, rather than the deterministic rule, is likely to yield the greatest benefits to managers of the firm.[23]

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[23] In the terminology of the previous footnote, positive correlation is generally associated with sub-additivity of real option values, and negative correlation with super-additivity of option values. These conclusions are reinforced further in the next set of examples 4.3b.

4.3b. Cross product price and cost correlation examples

We now demonstrate that introducing cross product price-cost correlation only serves to reinforce this conclusion. Using the same notation and parameter values as above we consider two further examples 4.3b:

C4. P_A, P_B *positively correlated* ($\rho = 0.5$); C_A, C_B *positively correlated* ($\rho = 0.5$)
Value of waiting = 39.92 ± 0.05 *€/hour*

C5. P_A, P_B *negatively correlated* ($\rho = -0.5$); C_A, C_B *negatively correlated* ($\rho = -0.5$)
Value of waiting = 41.96 ± 0.05 *€/hour*

Once again, application of decision rule D3 suggests that in the case of C4 the firm should allocate the 40 RH hours to t = 0 production of A, while for C5 the firm should wait until t = T to decide. Positive correlation decreases, and negative correlation increases, the value of the insurance provided to the multi-product firm through the ability to profitably reallocate productive capacity in response to perceived profit fluctuations. This inter-product flexibility in the presence of negative price correlation both clarifies the use of products as supporters, and illustrates the circumstances in which active management of the production process adds the greatest value to the firm. The outcome is that generalised price and cost uncertainty serves to reinforce the conclusions reached in example 4.2, which first introduces the risk diversification benefits to the firm of active management of the production process.

5. Conclusions

This article develops a real options framework to analyse the problem of choosing the optimal product mix in the presence of a limiting factor under conditions of price and cost uncertainty. It demonstrates that when there is uncertainty in the price (cost) of one or more products, the product mix that is advocated based on the usual management decision rule in a deterministic production environment, namely contribution per unit of limiting factor, produces sub-optimal results for the firm. Simply extending this rule to consider a product's expected profit contribution per unit of limiting factor is also inefficient. Instead, this paper demonstrates that the use of a decision rule based on a product's real options value per unit of limiting factor is the efficient way to proceed. The reason for this result arises from the failure of existing methods to incorporate the value of waiting, and their neglect of the potential impact of active management of the product mix selection process, causing them to ignore increases in firm value attributable to intra- and inter-product flexibility.

The above findings have several implications in a practical setting. When uncertainty exists and their firm is faced with a product mix selection problem, then the attention of decision makers should shift from the traditional criteria used in management accounting (contribution per unit of limiting factor) to the value that is generated by production flexibility.[24] Our proposed methodology suggests that managers can benefit considerably by delaying production and actively managing the allocation of their production capacity in the context of how uncertainty resolves itself. While the analysis helps resolve the question 'how much of each product should we produce?' it also provides useful insights into the more strategic question 'what should we produce in the first place?'. While the factors that influence the selection of a product line are many, and are customarily examined in the marketing literature, our analysis highlights one important aspect of the problem, the extent of price correlation between the products produced by the firm. Our analysis shows that in the presence of a limiting factor, other things being equal, a product mix exhibiting negative price correlation produces a higher contribution to profit under conditions of market uncertainty. The benefits from choosing to market products with negatively correlated prices are similar to those gained by portfolio diversification, and can significantly reduce losses caused by production capacity restrictions.

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[24] We believe that the potential benefits of our proposed methodology are not only restricted to product mix problems. Practitioners can also follow the same approach in solving *capital rationing* problems. In such situations, the firm is required to choose its capital expenditure program when resources are limited. Textbooks (for example, Brigham and Ehrhardt, 2003) often discuss the situation where finance capital is restricted, maintaining that managers must decide which projects a firm should undertake and which it should abandon, even when all projects in question produce positive NPV. While capital restrictions are incompatible with the notion of perfect capital markets, the availability of other factors of production such as management time, skilled labour, land, specialised equipment, etc. often constitutes an important constraint on the firm's ability to undertake all positive NPV projects. Our proposed methodology can be modified to help decision makers choose the optimal mix of projects that maximise the firm's value in the light of these restrictions. The valuation process of the optimal project mix is analogous to that of the optimal product mix, except we are using projects instead of products. In the context of our analysis, each project is equivalent to a separate product, the present value of net cash inflows is equivalent to the product's revenue, and the investment outlay of each project is equivalent to the product's total production cost. So long as this analogy is maintained, and the projects in question are divisible (i.e. fractional investments are feasible), then parallel results to those obtained above would apply to the capital rationing problem.

Appendix: extensions of the limiting factor decision rules

Section A: The formal linear programming solution

Assume that we are producing two products (i=A,B) in the presence of a limiting factor as defined in the text. Production earnings are increasingly uncertain over time due to price and cost fluctuations. With two products, we must consider the potential pay-offs from all resulting combinations of six possible different limiting factor allocation decisions.[25] These possible factor allocation decisions, and their resulting cash flow pay-offs if initiated are:

A.D1. Use the machine for H_A hours to produce product A at t=0 with resulting cash flow $H_A W_A(0)$
A.D2. Use the machine for H_B hours to produce product B at t=0 with resulting cash flow $H_B W_B(0)$
A.D3. Reserve $\bar{H}_A$ hours for the (possible) production of product A at t=T. The value of this decision at $t=0$ is $\bar{H}_A VW_{A,0}[\max\{W_A(T),0\}]$.
A.D4. Reserve $\bar{H}_B$ hours for the (possible) production of product B at t=T. The value of this decision at t=0 is $\bar{H}_B VW_{B,0}[\max\{W_B(T),0\}]$.
A.D5. Reserve $\bar{H}_{AB}$ hours for the (possible) production of either product A or product B at t=T. The value of this decision at $t=0$ is $\bar{H}_{AB} VW_{AB,0}[\max\{W_A(T),W_B(T),0\}]$.
A.D6. Reserve $\bar{H}_{A+B}$ hours for the (possible) production of both products at t=T. The value of this decision at $t=0$ is $\bar{H}_{A+B} VW_{A+B,0}[\max\{W_A(T),W_B(T),W_A(T),W_B(T),0\}]$.

Where $VW_{i,k}$ is the present value of waiting for decision i at time k, which is the expectation of the cash flow (under a risk neutral measure) discounted by the risk-free interest rate.

At this point it is possible to formulate the linear programming problem, the solution to which will maximise the value of the production mix: Maximise:

$$H_A W_A(0)+H_B W_B(0)+(\bar{H}_A VW_{A,0}[\max\{W_A(T),0\}]+\bar{H}_B VW_{B,0}[\max\{W_B(T),0\}]+\bar{H}_{AB} VW_{AB,0}[\max\{W_A(T),W_B(T),0\}]$$

$$+\bar{H}_{A+B} VW_{A+B,0}[\max\{W_A(T),W_B(T),W_A(T)+W_B(T),0\}],$$ subject to the following constraints:

$$H_A+\bar{H}_A+\bar{H}_{AB}+\bar{H}_{A+B}\le TH_A \qquad \text{(A.C1)}$$

$$H_B+\bar{H}_B+\bar{H}_{AB}+\bar{H}_{A+B}\le TH_B \qquad \text{(A.C2)}$$

$$H_A+\bar{H}_A+H_B+\bar{H}_B+\bar{H}_{AB}+2\bar{H}_{A+B}\le TMH \qquad \text{(A.C3), with } H_i,\bar{H}_i\ge 0.$$

Formal analysis of the linear programming problem

The solution of the formulated linear programming problem will give us the optimum production mix as it maximises the value of our decision. For the case of the two products the solution is simple enough to be presented and yields useful insight in the decision-making procedure. The problem can be broken down into three different cases, according to the relationship between the required production hours to fully satisfy demand and the total machine hours available.

Case A: $TMH \ge TH_A, TH_B$

This is the most general case, and is the one the paper considers in detail. Without loss of generality assume that $TH_A \ge TH_B$. Introducing $RH = TH_A + TH_B - TMH \ge 0$ it is clear that $(TH_i - RH) \ge 0$, and $DH = TH_A - TH_B \ge 0$. By setting:

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[25] With n products, the total number of decisions involving production pay-offs is found as follows. There are n possible combinations of producing only 1 product at t=0. Similarly, there are n possible combinations of producing only 1 product at time t=T. The possible combinations of possibly producing any 2 products out of n is given by ${}_nC_2$ and for each case we can either produce 1 or 2 products out of the 2 so in total we have $2\,{}_nC_2$ pay-offs. Similarly the possible combinations of possibly producing i products out of n is given by ${}_nC_i$ and in each case we can either produce 1, 2,..,i products out of the i so in total we have $i\,{}_nC_i$ pay-offs. Thus, in total:

Number of payoffs = $2n+\sum_{i=2}^{n} i\,{}_nC_i = n+n\,2^{n-1}=n(1+2^{n-1})$

Thus, with n = 2 there are six possible allocation decisions. For this result we use the fact that

$\sum_{i=1}^{n} i\,{}_nC_i = n\,2^{n-1}$, where ${}_nC_i=\dfrac{n!}{(n-i)!i!}$.

$$H_A = aDH + l(TH_B - RH) + bRH$$

$$\overline{H}_A = cDH + m(TH_B - RH) + dRH$$

$$H_B = e(TH_B - RH) + fRH$$

$$\overline{H}_B = g(TH_B - RH) + hRH$$

$$\overline{H}_{AB} = p(TH_B - RH) + iRH$$

$$\overline{H}_{A+B} = k(TH_B - RH) + nRH, \text{ with } 1 \geq a,b,\ldots, p \geq 0,$$

If $(TH_i - RH) = 0$, $RH = 0$, or $DH = 0$ then the relevant terms can be disregarded and (A.C1), (A.C2) and (A.C3) become:

$$(a + c)DH + (l + m + p + k)(TH_B - RH) + (b + d + i + n)RH \leq TH_A = DH + (TH_B - RH) + RH$$

$$(e + g + p + k)(TH_B - RH) + (f + h + i + n)RH \leq TH_B = (TH_B - RH) + RH$$

$$(a + c)DH + (l + m + e + g + p + 2k)TH_B + (b + d + f + h + i + 2n - l - m - e - g - p - 2k)RH \leq 2TH_B + DH - RH$$

Resulting in the following constraints:

$a + c \leq 1,$ (C1)
$l + m + p + k \leq 1,$ (C2)
$b + d + i + n \leq 1,$ (C3)
$e + g + p + k \leq 1,$ (C4)
$f + h + i + n \leq 1,$ (C5)
$l + m + e + g + p + 2k \leq 2,$ (C6)
$b + d + f + h + i + 2n \leq 1.$ (C7)

Note, that whenever (C2) and (C4) are satisfied so is (C6), and (C7) is stricter than both (C3) and (C5), so whenever it is satisfied so are these two. Therefore, the seven constraints can effectively be reduced to four; (C1), (C2), (C4) and (C7):

$a + c \leq 1,$
$l + m + p + k \leq 1,$
$e + g + p + k \leq 1,$
$b + d + f + h + i + 2n \leq 1.$

Substituting $H_A,\ldots,\overline{H}_{A+B}$ into the functional we want to maximise yields:

$$DH(aW_A(0) + cVW_{A,0}[\max\{W_A(T),0\}]) + (TH_B - RH)(lW_A(0) + mVW_{A,0}[\max\{W_A(T),0\}] + eW_B(0) + gVW_{B,0}[\max\{W_B(T),0\}] +$$

$$pVW_{AB,0}[\max\{W_A(T),W_B(T),0\}] + kVW_{A+B,0}[\max\{W_A(T),W_B(T),W_A(T) + W_B(T),0\}]) + RH(bW_A(0) + dVW_{A,0}[\max\{W_A(T),0\}] +$$

$$fW_B(0) + hVW_{B,0}[\max\{W_{B2}(T),0\}] + iVW_{AB,0}[\max\{W_A(T),W_B(T),0\}] + nVW_{A+B,0}[\max\{W_A(T),W_B(T),W_A(T) + W_B(T),0\}])$$

Note that the original problem now has been reduced to the following three:

A.P1: Maximise: $DH(aW_A(0) + cVW_{A,0}[\max\{W_A(T),0\}]$, subject to $(a + c) \leq 1$.
The solution to this problem is found by selecting $\{W_A, VW_{A,0}[\max\{W_A(T),0\}]\}$, and since $(a + c) \leq 1$ we select either $(a,c) = (0.1)$ or $(a,c) = (1,0)$.

A.P2: Max: $(TH_B - RH)(lW_A(0) + mVW_{A,0}[\max\{W_A(T),0\}] + eW_B(0) + gVW_{B,0}[\max\{W_B(T),0\}] + pVW_{AB,0}$ $[\max\{W_A(T),W_B(T),0\}] + kVW_{A+B,0}[\max\{W_A(T),W_B(T),W_A(T) + W_B(T),0\}]$, subject to constraints: $l + m + p + k \leq 1$, $e + g + p + k \leq 1$. For this problem begin by noting that:
$VW_{A+B,0}[\max\{W_A(T),W_B(T),W_A(T) + W_B(T),0\}] = VW_{A,0}[\max\{W_A(T),0\}] + VW_{B,0}[\max\{W_B(T),0\}]$.

Setting $\bar{m} = m + k, g = \bar{g} + k$, the problem becomes:

Max: $(TH_B - RH)(lW_{A1}(0) + \bar{m}VW_{A,0}[\max\{W_A(T),0\}] + eW_B(0) + \bar{g}VW_{B,0}[\max\{W_B(T),0\}] + pVW_{AB,0}[\max\{W_A(T),W_B(T),0\}]$, subject to: $l + \bar{m} + p \leq 1$, $e + \bar{g} + p \leq 1$.

Now the choice involves selecting the $\max\{\max\{W_A,VW_{A,0}\} + \max\{W_B,VW_{B,0}\},VW_{AB,0}\}$. By taking into account the fact $\max\{W_A,VW_{A,0}\} + \max\{W_B,VW_{B,0}\} \geq VW_{AB,0}$, to maximise we select:
$\max\{W_A(0),VW_{A,0}[\max\{W_A(T),0\}]\}$, and $\max\{W_B(0),VW_{B,0}[\max\{W_B(T),0\}]\}$

A.P3: Maximise:
$RH(bW_A(0)+dVW_{A,0}[\max\{W_A(T),0\}]+fW_B(0)+hVW_{B,0}[\max\{W_B(T),0\}]+iVW_{AB,0}[\max\{W_A(T),W_B(T),0\}]+nVW_{A+B,0}[\max\{W_A(T),W_B(T),W_A(T)+W_B(T),0\}]$, subject to $b + d + f + h + i + 2n \leq 1$.
In this case again it is possible to set $\bar{d} = d + n$ and $\bar{h} = h + n$, and the problem becomes, Max:
$RH(bW_A(0)+\bar{d}VW_{A,0}[\max\{W_A(T),0\}]+fW_B(0)+\bar{h}VW_{B,0}[\max\{W_B(T),0\}]+iVW_{AB,0}[\max\{W_A(T),W_B(T),0\}]$ subject to $b + \bar{d} + f + \bar{h} + i \leq 1$.
The solution here is found by selecting $\max\{W_A,VW_{A,0},W_B,VW_{B,0},VW_{AB,0}\}$. By taking into account the fact that $VW_{AB,0} \geq VW_{A,0},VW_{B,0}$ this reduces to selecting $\max\{W_A,W_B,VW_{AB,0}\}$.

Summarising, the three linear programming problems generate the following solutions:

A.S1: From A.P1 for allocating the *DH* hours we select the decision that results from:
$\max\{W_A,VW_{A,0}[\max\{W_A(T),0\}]\}$

A.S2: From A.P2 for allocating the $(TH_B - RH)$ hours we select the decision that results from:
$\max\{W_A(0),VW_{A,0}[\max\{W_A(T),0\}]\} + \max\{W_B(0),VW_{B,0}[\max\{W_B(T),0\}]$

A.S3: From A.P3, for allocating the *RH* hours we select the decision that results from:
$\max\{W_A(0),W_B(0),VW_{AB,0}[\max\{W_A(T),W_B(T),0\}]\}$

This final result is that discussed in the text of the paper. The optimal decision requires the allocation of $(TH_A - RH)$ machine hours in total to the possible production of product A, with production occurring either at t=0 or t=T. Similarly, $(TH_B - RH)$ machine hours should be allocated to the possible production of product B in the same timeframe. Finally, the remaining RH hours should be allocated for the production of either product A or B at t=0, or used to retain the option to possibly produce either of the products at t=T. This is precisely the rule developed in Section 3.2 in the body of the paper.

Case B: $TH_A \geq TMH \geq TH_B$
Here we define $DH = TMH - TH_B$. By setting:

$$H_A = aTH_B + bDH$$
$$\bar{H}_A = cTH_B + dDH$$
$$H_B = eTH_B$$
$$\bar{H}_B = fTH_B$$
$$\bar{H}_{AB} = gTH_B,$$
$$\bar{H}_{A+B} = hTH_B, \text{ with } 1 \geq a,\ldots,h \geq 0,$$

the linear programming problem can be reduced to the following two independent problems :

B.P1: Maximise:
$TH_B(aW_A(0)+eW_B(0)+cVW_{A,0}[\max\{W_A(T),0\}]+fVW_{B,0}\max\{W_B(T),0\}]+gVW_{AB,0}[\max\{W_A(T),W_B(T),0\}]+hVW_{A+B,0}[\max\{W_A(T),W_B(T),W_A(T)+W_B(T),0\}])$,
subject to $a + c + e + f + g + 2h \leq 1$.

B.P2: Maximise:
$DH(bW_A(0) + dVW_{A,0}[\max\{W_A(T),0\}])$ subject to $b + d \leq 1$.
Problem (B.P1) can be reduced to the problem (A.P3) by introducing $\bar{c} = c + h$ and $\bar{f} = f + h$, resulting in $\bar{c} = \bar{f} = 0$. The decision will depend upon how $VW_{AB,0}[\max\{W_A(T),W_B(T),0\}]$, $W_A(0)$ and $W_B(0)$ compare with the coefficient of the maximum term taking the value 1 while the remaining terms are set equal to zero. The solution of the problem (B.P2) is easily found by selecting the maximum of the two $W_A(0)$ and $VW_{A,0}[\max\{W_A(T),0\}]$ terms. Effectively, both products are competing for TH_B hours. Thus, we must choose whether we produce one of them now or wait to possibly produce one of them in the future. This decision will depends on how $VW_{AB,0}[\max\{W_A(T),W_B(T),0\}]$, $W_A(0)$ and $W_B(0)$ compare. Finally, for the hours that remain we must select whether we should produce product A at t=0 or wait and decide at time t=T.

Case C: $TMH \leq TH_A, TH_B$

In this final case we set:

$H_A = aTMH$

$\bar{H}_A = bTMH$

$H_B = cTMH$

$\bar{H}_B = dTMH$

$\bar{H}_{AB} = eTMH$

$\bar{H}_{A+B} = fTMH$, with $1 \geq a, \ldots, f \geq 0$,

so the problem is reduced to:

(C.P1) Maximise
$TMH(aW_A(0)+bVW_{A,0}[\max\{W_A(T),0\}]+cW_B(0)+dVW_{B,0}[\max\{W_B(T),0\}]+$
$eVW_{AB,0}[\max\{W_A(T),W_B(T),0\}] + fVW_{A+B0}[\max\{W_A(T),W_B(T),W_A(T)+W_B(T),0\}],$
subject to $a + b + c + d + e + 2f \leq 1$.
Now we introduce $\bar{b} = b + f$, $\bar{d} = d + f$ which reduces the problem to either (A.P3) or (B.P1). This is maximised if we keep the maximum term, as previously $\bar{b} = \bar{d} = 0$, and then depending upon how $VW_{AB,0}[\max\{W_A(T), W_B(T),0\}]$, $W_A(0)$ and $W_B(0)$ compare, we select the optimal production plan. Clearly, this problem represents the case of only having the capacity to fully produce (in the best scenario), one of the two products. In this case, it is intuitively obvious that we should either select to utilise all the capacity we have to fully produce one of the products at t=0, or wait to use the entire capacity to (possibly) produce only one of them at t=T.[26]

Section B: Extending the decision rule to n-products

Assume that we are producing n products in the presence of a limiting factor as defined in the text. Production earnings are increasingly uncertain over time due to price and cost fluctuations. The total hours required for the production of each product are given by:

$TH_i = MH_i\, TQ_i$, i=1,...,n

and for the problem to represent a limited factor problem it must be the case that:

$$\sum_{i=1}^{n} TH_i > TMH.$$

In this problem the decision is more complicated as you can choose to forgo production today, t=0, and save machine hours that can be utilized in the future, t=T. The detailed choices you are facing and must evaluate with n products are the following.[27] The value of:

B.1 All possible production combinations involving the production of 1 product, out of a total of *n* products, at t=0.

B.2 All possible production combinations involving t=T production of 1 product, out of a total of *n* products, in the future.

B.3 All possible production combinations which require selecting 1 product out of 2, in a total of *n* products, at t=T.

B.4 All possible production combinations which require selecting 2 products out of 2, in a total of *n* products, at t=T.

B.5 All possible production combinations which require selecting 1 product out of 3, in a total of *n* products, at t=T.

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[26] From the solution to the problem we note there are cases in which the decision can be broken down into a linear combination (with positive coefficients) of other decisions that use independent resources. The meaning of independent resources in this context is similar to that used in the body of the main paper. The outcome is that it is possible to subsume this problem into previously solved ones. If we decide to solve the decision problem without absorbing it, then it is possible in some cases that the coefficients will admit an infinite number of values. However, in this case, all the solutions are equivalent. This is perhaps most readily seen in case (A.P2), where $\bar{g} = g + k$ and $\bar{m} = m + k$. In this case if the solution to the problem is $\bar{m} = \bar{g} = 1$ then g can take any value in the interval, in which case it follows that $k = 1 - g$ and $m = g$.

[27] In the two-product situation considered in Section A, there are (only) four possible choices to evaluate: B.1 All possible production combinations involving the production of 1 product, out of a total of 2 products, at t=0 which leads to evaluation of factor allocation decisions A.D1 and A.D2. B.2 All possible production combinations involving t=T production of 1 product, out of a total of *n* products, in the future, leading to evaluation of A.D3 and A.D4. B.3 All possible production combinations which require selecting 1 product out of 2, in a total of 2 products, at t=T which leads to A.D5. Finally, B.4 All possible production combinations which require selecting 2 products out of 2, in a total of 2 products, at t=T, which generates A.D6.

B.6 All possible production combinations which require selecting 2 products out of 3, in a total of *n* products, at t=T.

B.7 All possible production combinations which require selecting 3 products out of 3, in a total of *n* products, at t=T.

...

$\frac{n(n+1)}{2}+1$. All possible combinations of producing *n* products out of *n*, out of a total of *n* products, in the future. For each of these combinations we have a pay-off function, which will be used to value each decision option and the total number of pay-offs we should obtain is $n(1 + 2^{n-1})$ (see footnote 25). The intuition behind the next step in deriving the pay-offs can be more easily explained by reference to a specific example. In the chosen example, we analyse B.6 for *n=3* (A, B, C) in which case the number of possible combinations of 2 products out of a total of 3 products will be 3. That means that in this case we face the following three different production allocation decisions:

(i) Save H_{AB} hours for the (possible) production of either product A or product B in the future.
(ii) Save H_{AC} hours for the (possible) production of either product A or product C in the future.
(iii) Save H_{BC} hours for the (possible) production of either product B or product C in the future.

At *t=T* in each of these cases we are facing the following possibilities:

1. The production of both products will incur losses, in which case we produce neither.
2. The production of one product will incur losses, in which case we produce the other product.
3. The production of both products will be profitable, in which case we produce the most profitable.

These possibilities result in the following pay-off functions:

$$H_{AB}\max\{W_A(T),W_B(T),0\},\ H_{AC}\max\{W_A(T),W_C(T),0\},\ H_{BC}\max\{W_B(T),W_C(T),0\}.$$

Therefore, the value of each decision or equivalently the value of waiting for each decision is:[28,29]

$HA_BVW_{AB,0}[\max\{W_A(T),W_B(T),0\}],H_{AC}VW_{AC,0}[\max\{W_A(T),W_C(T),0\}],H_{BC}VW_{BC,0}[\max\{W_B(T),W_C(T),0\}]VW_{i,k}$: Value of waiting for decision *i* at time instant *k*.

In general, the number of terms in the pay-off function for up to *m* products when there are k products in total involved in the production process, is given by:

$$\sum_{i=0}^{m}\frac{k!}{i!(k-i)!}.^{30}$$

In the above example as *m=1*, *k=2* this results in (1+2)=3 terms.

Following the derivation of all the possible decisions and their subsequent valuation, it is possible to formulate a linear programming problem using an analogous procedure to that outlined for the two product case in Section A. The solution to this linear programme will generate the optimal production mix.

Section C: Extending the decision rule to n-periods

In this case we assume that it is possible start production and sell output[31] at any time instant during the deferral period [0,T] rather than simply at the beginning or the end. We demonstrate that the valuation of each decision in this case, which is equivalent to a real American option, is somewhat more complicated compared to the case of the European option as it involves certain 'non-linearities' and the final result depends on the 'exercise' or production strategy selected. However, we emphasise that all the decision rules derived in the text and in the Appendix, section A remain valid.

We analyse the *n* period case in discrete time by dividing the time interval [0,T] into *N* equal subintervals of length Δt, and denote by $(\Omega,\{F_n\},F,P)$ a filtered probability space with F_0 representing the initial information set.[32] Begin by considering an option with a pay-off function, either for early exercise or exercise at the end of the deferral period, which is denoted by $g_i = g(S(T_i),T_i)$, $i=0,..,N$. At $t=T$ we have the pay-off $Pf_N = g(S(T_N),T_N)$ and the value of waiting at T_{N-1} is given by discounting the expectation of the time T pay-off under a risk-neutral measure. Therefore, the value of waiting is given by $VW_{N-1} = e^{-r\Delta t}E[Pf_N \mid F_{N-1}]$. So, at $t=T_{N-1}$ after com-

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[28] Note, by setting $NE_i = P_i - C_i$ and $F_{ij} = \frac{MH_i}{MH_j}$, this is equivalent to $\frac{H_{AL}}{MH_A} VW_{AL,0}[\max\{NE_A,NE_iF_{Ai},0\}]$, which is equivalent in its effect to properly adjusting by FA_i the possible future earnings NE_i, $i=B,C$ enabling one to find the value of waiting.

[29] The concept of the value of waiting is described in more detail later.

[30] This is the sum of all possible combinations.

[31] Thus, demand is now effectively modelled as a continuous flow demand throughout the period.

[32] More specifically we have (Ω,F,P) a probability space and $(F_n : n = 1,\dots,N)$ a sequence of σ-algebras on F.

paring the respective pay-offs, we can either exercise or decide to wait, and the resulting pay-off is $Pf_N-1 = \max\{g_{N-1}, e^{-r\Delta t}E[Pf_N \mid F_{N-1}]\}$. This implies the value of waiting at T_{N-2} is given by $VW_{N-2} = e^{-r\Delta t}E[Pf_{N-1} \mid F_{N-2}]$. In a similar fashion, it is possible to keep working backwards in time by using the following recursive step (Bingham and Kiesal (2000), p.125):

$$Pf_{n-1} = \max\{g_{n-1}, e^{-r\Delta t}E[Pf_n \mid F_{n-1}]\}$$

with the first alternative on the right corresponding to the pay-off if production is resumed immediately, and the second corresponding to the value of waiting. By introducing $\overline{Pf}_n = e^{-rn\Delta t}Pf_n$, the discounted pay-off, we obtain:

$$\overline{Pf}_{n-1} = \max\{\bar{g}_{n-1}, E[\overline{Pf}_n \mid F_{n-1}]\}.$$

Thus, $(\overline{Pf}_n)$ is the Snell envelope[33] of the discounted pay-off process $(\bar{g}_n)$ and $\overline{Pf}_0$ represents the value of the option, while the value of waiting at T_0 is given by $VW_0 = e^{-r\Delta t}E[Pf_1 \mid F_0] = E[\overline{Pf}_1 \mid F_0]$. Obviously, at each time instant n, if the value of waiting $e^{-r\Delta t}E[Pf_n \mid F_{n-1}]$ is greater than the immediate pay-off g_{n-1} then you wait, but if the value of waiting is less than or equal to the immediate pay-off, then you exercise.

Initially, we calculate the value of waiting $VW_{1,0}$ for the decision to defer the production of product 1 at time T_0. The pay-off at time T_N is given by $Pf_{1,N} = \max\{W_{1,N}, 0\}$ which states that at the end of the deferral period we can either produce or decide to abandon production altogether. Following the preceding analysis, the value of waiting at T_{N-1} is given by $VW_{1,N-1} = e^{-r\Delta t}E(Pf_{1,N} \mid F_{N-1})$. At time T_{N-1} we are faced with the question: Should we defer production or produce now? The answer depends on how the value of waiting compares with that of producing. It follows that the pay-off at T_{N-1} is given by $Pf_{1,N-1} = \max\{W_{1,N-1}, VW_{1,N-1}\}$. From this pay-off it is possible to find the value of waiting at the time instant T_{N-2}, which is given by: $VW_{1,N-2} = e^{-r\Delta t}E(Pf_{1,N-1} \mid F_{N-2})$. Similarly, the pay-off at T_{N-2} is found to be $Pf_{1,N-2} = \max\{W_{1,N-2}, VW_{1,N-2}\}$, from which it is possible to find $VW_{1,N-3}$ and continuing with this backward recursive process it is possible to find $VW_{1,0}$. Analogously, we obtain $VW_{2,0}$.

In order to value the option of producing either product 1 or product 2, we again start from T_N where the pay-off is $Pf_{12,N} = \max\{W_{1,N}, W_{2,N}, 0\}$. It follows that at T_{N-1} the value of waiting is given by $VW_{12,N-1} = e^{-r\Delta t}E(pf_{12,N} \mid F_{N-1})$. At T_{N-1} we face the following mutually exclusive alternatives: either immediately producing one of the two products, or keep on waiting. The resulting pay-off is given by $Pf_{12,N-1} = \max\{W_{1,N-1}, W_{2,N-1}, VW_{12,N-1}\}$. In similar fashion, we continue to move backwards in time in order to calculate $VW_{12,0}$.

Finally, to value the option of being able to produce both products (each for $\bar{H}_{1+2}$ hours) we start from T_N where the pay-off is $Pf_N = \max\{W_{1,N}, W_{2,N}, W_{1,N}+W_{2,N}, 0\}$. In this case we can distinguish two cases, which differ depending on the assumptions made about the exercising strategy:

A1. We can assume that, if at any time we decide to exercise the option and undertake production, then we produce both products simultaneously.

A2. We can assume that the exercise strategy allows at any time instant for one of the following: production of both products, production of one of the products, or production of none. The exercise policy in case A1 is very restrictive, and we only include it for the sake of completeness. If we denote by $VW_{1+2,0}$ the value of waiting it follows that $VW_{1+2,0} \leq VW_{1,0}+VW_{2,0}$.

It is almost never optimal to reserve $\bar{H}_{1+2}$ hours of production for product 1 and $\bar{H}_{1+2}$ hours of production for product 2, and then decide to produce them simultaneously. If on the other hand we decide to adopt the exercise policy given by A2, then it follows that at T_{N-1} the value of waiting is given by $VW_{1+2,N-1} = e^{-r\Delta t}E(Pf_N \mid F_{N-1})$. At T_{N-1} we are facing the following options:

(i) Produce both products;
(ii) Produce one of the two products and wait for the other one;
(iii) Wait for both.

As a result at this time instant the resulting pay-off is given by $Pf_{1+2,N-1} = \max\{W_{1,N-1}+W_{2,N-1}, W_{1,N-1}+W_{2,N-1}, W_{2,N-1}, VW_{1,N-1}, VW_{1+2,N-1}\}$, and the value of waiting is given by $VW_{1+2,N-2} = e^{-r\Delta tE}(Pf_{1+2,N-1} \mid F_{N-2})$. Using the standard backward recursive approach outlined above, we eventually find the $VW_{1+2,0}$ at time T_0. A2 introduces more flexibility into the production planning, and it can be demonstrated that $VW_{1+2,0} = VW_{1,0} + VW_{2,0}$, resulting in a more valuable exercise policy than policy A1. This fact also means that in parallel with the results from European option analysis in Section A, the n period decision can be replicated by another existing one, using only positive coefficients, and need not be considered separately.[34]

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[33] The Snell envelope is a process that at every instant in the life of the security gives us the maximum over all the expected values of the discounted reward process at every stopping time in the period to expiry.

[34] In the case of American type options, at the next time instant we face a new linear programming problem to decide what to do next. In the European analysis we simply wait for the end of the period under consideration.

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Government concerns and tensions in accounting standard-setting: the case of accounting for the Private Finance Initiative in the UK

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Abstract—The setting of accounting standards in the UK has always and will always be surrounded by tensions due to the different interests of those who are involved either in the production or operation of the resulting standards. While some interests come and go, the UK's governments, over time and of all political persuasions, have a continuing concern that the actions of the accounting profession more generally, and the content of accounting standards specifically, should be perceived to be in the public interest. Although the views on what is in the public interest change over time, what is clear is that where this public interest is perceived *not* to be upheld, then tension between the government of the time and (primarily) the accounting standard-setting bodies is inevitable. At these times various forms of questioning of the actions of accounting standard-setting bodies occur. However, it is important to stress that when the public interest is perceived to be upheld, no overt tension is apparent, but this does not mean that this underlying concern does not exist. This paper's main focus is on one of the most recent points of overt tension related to accounting for the Private Finance Initiative (PFI). It locates this specific tension in an historical analysis of the battles that have led to and challenged the accounting profession's hard-won ability to regulate itself. It also compares and contrasts the disagreement surrounding accounting for PFI with a not dissimilar point of tension surrounding accounting for inflation in the 1970s and 1980s. This comparison is used to provide a richer historical understanding of what is argued to be a general and ongoing watching brief by any UK government (of any political persuasion) over the self-regulatory processes of the UK's accounting profession that they are working in the public interest.

1. Introduction

There has always been potential for tensions in the setting of accounting standards to guide accounting practice both in the private and public sectors. A close inspection of the disagreements surrounding the formulation and operation of certain current or past Statements of Standard Accounting Practice (SSAPs) or Financial Reporting Standards (FRSs) demonstrates these tensions. While the interests of certain parties tend to relate to particular instances, there is an ongoing potential for underlying tension and concern between governments in the UK and the accounting profession and, more specifically, the Accounting Standard Board (ASB). The tangible effect of disagreement has been expressed in different forms over the years and whilst this potential for disagreement does not always materialise it remains a possibility. It is thus a latent tension – one which is only apparent when certain circumstances occur and conditions apply. This paper argues that the possibility of tensions (in different forms) arises from the government's view that the self-regulating accounting profession, guided by accounting standard-setters, should be working in the public interest. Clearly, what is seen as the public interest remains in the government's control and is therefore mutable. When the public interest is perceived *not* to be satisfied tensions in the form of debates about particular forms of accounting become apparent. This paper revisits this ongoing concern, concentrating on one of the latest points of explicit conflict in relation to how to account for the Private Finance Initiative (PFI). As will become apparent, while the initial major differences between the Government and the ASB seem to be resolved, there are subtle strategies at work in this resolution. These allow the Government's perceived public interest to be satisfied without direct disagreement with the ASB's judgments. This paper explicates these processes, locating them in

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the historical context of previous battles for self-regulation of the accounting profession. It compares and contrasts accounting for PFI with the debates about accounting for inflation that occurred in the 1970s and 1980s. This analysis is linked to the public interest thesis and the surrounding tensions.

PFI was introduced in 1992 as a way for the private sector to supply 'property-based services'[1] to the public sector in exchange for an ongoing monthly cost over a long period (often 30 and sometimes up to 60 years). The accounting question is whether there is within these services a separable property element. This leads to a further question concerning asset recognition and on whose balance sheet such an asset should appear. The disagreements surrounding these questions and the consequent implications for accounting for PFI are a central focus for this paper. Put simply, Her Majesty's Treasury (HMT) on behalf of the UK Government was, and arguably still is,[2] of the view that a PFI contract is an indivisible set of services where asset recognition is irrelevant. HMT's view is that, for complex reasons (to be discussed in more depth later in this paper) this concern is not just irrelevant but has negative perceived economic repercussions. This is particularly the case if the property part of the services is deemed to be an asset and appears on the balance sheet of the public sector. The ASB, on the other hand, sees contracts in all cases as separable into property and other service elements. Therefore, asset recognition is always of major importance and in many cases this leads to PFI transactions appearing on public sector balance sheets. This public disagreement, set within the context of other similar public disputes in which accounting action and/or specific accounting treatments occurs, will be the central focus of this paper.

PFI contracts differ from traditional contracts for the supply of services. A traditional contract makes a clear distinction between property and other soft service elements. A traditional procurement contract for property involves the public sector purchaser specifying the design of a building that is built by the private sector supplier and handed over to the public sector purchaser. In these circumstances the public sector purchaser has an obvious asset ownership of the property. Operating this property may involve the private sector if it is contracted out, but it could also be managed directly by the public sector alone. With a PFI contract the private sector supplier designs, builds, finances and operates a property-based service for the public sector, based on a service output specification. Many PFI contracts will only cover part of the total services required by the public sector partner. Thus, for instance in the UK, the medical care in hospitals and the teaching in schools and universities will continue to be the responsibility of the public sector. Other services will be supplied by the private sector in exchange for a monthly payment (which originally was split between an availability and performance elements but now is a unitary payment). Such payments are contractually defined and run for a period usually of up to 30 years (in some cases this is extended to 60 years). Unlike BOO (Build Own Operate) or BOOT (Build Own Operate and Transfer) schemes, where the asset ownership of the property element is seemingly clear,[3] in PFI projects asset ownership of the property element is both uncertain as well as contentious.

There have been a number of attempts by both the government (primarily through HMT) as well as the ASB to resolve the issue of the nature of the accounting treatment. The first solution offered came in some HMT guidelines (issued in September 1997). These guidelines were in response to a recommendation to develop accounting rules for PFI coming from a major Government review into PFI, established soon after the Labour Government came to power in May 1997. The September 1997 guidelines were 'interim' pending the views of the ASB. The ASB's views were made plain in an Exposure Draft (ED) (in December 1997) and in a final standard (an amendment to Financial Reporting Standard No. 5 (FRS5)) in September 1998. Finally, in June 1999, HMT issued its revised guidelines, which provided an 'interpretation' for the public sector of the ASB's standard. This paper explores these various accounting recommendations, setting them within the context of ongoing tensions and concerns between governments and the accounting profession targeted on the ASB (and its forebears).

The remainder of this paper is divided into four further sections followed by a conclusion. Section 2 provides the context for the specific issues surrounding accounting for PFI by clarifying the roles of the UK government and the ASB and its predecessors,[4] exploring reasons for possible points of tensions and reactions to them. In this we will concentrate on the different responses to these difficulties over the years as a way to provide an historical appreciation for the reaction to the PFI incident. The third section looks in more detail at the nature of PFI and specifically at the reasons why the accounting treatment became contentious. Section 4 concentrates on various accounting recommendations, starting with the HMT's 1997 PFI accounting guidelines, leading to the ASB's 1997 ED and the 1998 standard (amendment to FRS5) and finally to HMT's 1998 guidelines which provide an 'interpretation' of the ASB's standard. A major element in this section will be a discussion of the way there has been a seeming compliance to the wishes of the ASB which, at the same time, allows original government intentions to be realised. The fifth section compares and contrasts the PFI incident with another point of tension in the 1970s and 1980s in relation to accounting for inflation. This draws out further insights into this ongoing public interest concern of UK governments over time. The final concluding section draws the analysis together, and provides a few pointers to future relationships between the government and the ASB based on the paper's contents.

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[1] A term used by Jeremy Colman, the deputy auditor general leading PFI work in the National Audit Office (NAO).

[2] The issues surrounding accounting for PFI relates to a period in the late 1990s. The actions of HMT indicate that the accounting treatment was very sensitive at that time. The view of HMT at the present time is more mixed. Officially it is that '...the accounting treatment of a PFI project on a departmental balance sheet is not material to the government's decisions about when to use PFI' (HMT (2003) para. 2.26:24). However, our argument, as will be made clear below, is that it was *perceived* to be material in the late 1990s and this led HMT to act in the way that they did. Our view, again, is that a number of material changes have occurred since this time which allows the HMT to make this statement now. This does not, however, mean that the HMT have changed their view about the indivisibility of the contract. It also does not mean that, in some parts of Government, PFI transactions appearing on the balance sheet of the public sector remains a perceptual economic problem. We will explore these points further below.

[3] This, of course, assumes that the nature of the BOO and BOOT schemes do not change as the contract develops – something which cannot always be assured.

2. Government, law and accounting standard-setters: a theoretical and historical analysis of tensions

Accounting has gained and maintained its independent status and privilege because it has managed to convince both state and the polity that it is working in the public interest. As Robson et al. (1994:533) make plain:

> 'The accounting occupation has, in common with other occupational groups, connected its practices to the service ideal or "Public Interest" that is allegedly secured by those practices (in return for monopoly control). Ideological narratives are linked to the discourses of legitimation: stories and histories surrounding the development of particular practices that contrive to portray particular forms of social practice as worthy and legitimate.'

Robson et al. refer to this process as a form of 'ideology'. However, they are not using ideology in the sense of false consciousness (Larrain, 1979) as is often associated with the term, but as something which is 'deeply implicated in the conditions that make the practices of accountants credible' (Robson et al., 1994:532). It is ideology that gives legitimacy and credibility to accounting that it is working in the public interest. This is not some time-invariant ideological commitment but is caught in an ongoing and inevitable interpretation process that is subject to constant scrutiny and question. It is the ideological success (or lack of it) which gives accounting its standing (or its problems).

2.1. A theoretical perspective: Habermas and Steering

While the polity can question and challenge the actions of accountants in terms of the public interest, the state, in the form of the government of the day, does have power to do something about it when these doubts arise. Government, as a state authority, is there in Habermasian terms to 'steer systems' (cf. Habermas, 1984, 1987, 1996; Broadbent et al., 1991; Power and Laughlin, 1996) such as the accounting profession (or any profession) to work in the public interest. This judgment and this role of government is given its own legitimacy by the changing contents of what Habermas refers to a 'societal lifeworld' which is the accumulated discursively agreed beliefs, views and values concerning our world, our interrelationships and ourselves. This lifeworld changes over time and generates a range of tangible organisations (systems) that express and operationalise these lifeworld concerns. As society progresses and becomes more complex, institutional steering media (e.g. governments) are needed to ensure that the increasing quasi-independent systems continue to express lifeworld aspirations and intentions. In democratic countries we give government power and authority, partly exercised through the law, to enable, but also to take away, freedoms to these professions and organisations (societal systems). Therefore, they have a watching brief, reinforced through law to ensure that the public interest is furthered by these organisational systems. They are, in Robson et al.'s (1994:531) words, concerned with the 'regulation *of* the profession'. How the exercise of this right is largely (again using Robson et al.'s 1994:531 terms) dependent on how credible and valid is the 'regulation *by* the profession, which includes, for example, [how] accountants report on economic organisations'.

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[4] While the historical survey that follows is necessarily selective we believe it provides a representative insight into the public interest thesis of this paper. Equally, while the PFI incident is topical and current this is only one of the points of tension at the moment. The Enron and WorldCom scandals are prime examples of other similar cases where the custodial role of self-regulation of accounting will again be under scrutiny and pressure. Whether these pressures will be as great and as extensive in the UK as in the US, where the regulatory control system is somewhat different to this country's, remains to be seen. This paper is not about this likely point of strain or how the government and the accounting profession will react to these pressures. Note, however, that this is another example of the generic class of tension which is the focus of the paper.

Sometimes, however, these societal steering processes may become distorted in that they are not aligned to the lifeworld. In such circumstances Habermas sees this as a start to what he refers to as the 'colonisation of the lifeworld', where changes in the societal steering institutions drive unwanted changes in the lifeworld through controlling societal organisations to break away from lifeworld demands. This is only possible because of the unique and clear role for governments: to steer and intervene if they *perceive*[5] systems are not working according to societal expectations. These government interventions are driven by *perceived* lifeworld requirements, assuming they are trying to adhere to their defined societal role. It is these perceptions and their links to the societal lifeworld that produce the judgments as to what is deemed to be in the public interest.

To avoid these interventions, and maintain the quasi-independence that societal systems have acquired, they need to demonstrate that they can manage and regulate themselves to be working in the public interest. Where this is not the case they will be under pressure from the particular government of the day. This pressure may lead them to lose their self-regulating professional (or organisational) status. Alternatively, they may have to modify their regulatory processes or modify their specific stance or convince government that its behaviour is actually in the public interest.

While this is a general model of societal relationships, our focus in the paper is more modest, dealing as it does with the relationships between successive governments and the accounting profession. The historic picture that follows provides examples of particular points where there has been or was about to be a government intervention based on the above public interest thesis. In each case a perceived set of societal economic issues and crises was seen to be the 'fault' of deficient accounting practices, bringing into question the issue of whether the accounting profession was working in the public interest and whether its practices were 'appropriate'. In each such situation, the government either was about to act or did act in ways that could have curtailed the independence of the accounting profession. The very creation of the accounting standard-setters was generated by these economic concerns. They came into existence to ensure that the accounting profession is perceived to be working in the public interest.[6] It seems that whenever these pressures arise the accounting profession, and more particularly the accounting standard-setters, will do whatever is necessary to ensure that self-regulation is maintained as far as possible.

Before looking at both the emergence of the accounting profession and two points of government tension that generated the self-regulatory mechanisms for the accounting profession (sub-sections (2.2) and (2.3) below), it is important to bear in mind that Habermas's model of steering also applies to the accounting profession even though it is within the macro model a societal system. The accounting profession has, conceptually, its own equivalent lifeworld, steering process and systems (cf. Broadbent et al., 1991; Laughlin, 1991). The steering processes are the work of the ASB and its forebears,[7] whose guiding force is the accounting profession's lifeworld. This could also be a point of tension with the societal steering institutions. In good faith, and following the dictates of the accounting profession's lifeworld, the various recommendations could make little sense from a societal perspective. This actually occurred in the case of accounting for PFI, as we will see.

2.2. *The emergence of the accounting profession*

The accounting profession's independence to be able to act in the public interest is of recent origin and required initially breaking free from the legal profession. As Napier and Noke (1992) indicate, it was not until the late 18th century that accounting became, in any sense, independent of the legal profession.

As Sikka and Willmott (1995:552) make plain, it was the Companies Act of 1862 that developed the need for an 'official liquidator to oversee the winding up of insolvent companies, a domain reserved for an elite of accountants who were acceptable to the authorities'. This, coupled with other changes from the 1862 Act – particularly in relation to ensuring that dividend payments to shareholders be made from income – which, in effect, needed to be measured accurately, gave the embryonic profession the boost that it needed to achieve its own independence. This it did initially through the formation of its own professional body – the

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[5] 'Perception' will play a major role in this paper. Our concern is not to question these perceptions but rather to understand why governments act. It is not for us to judge whether the reasons that guide such actions are fallacious or not. That is for a separate analysis.

[6] The division of roles within the accounting profession is seen by Broadbent and Laughlin (2002) as a divide between being seen as legitimisers of the capital accumulation process whilst also wanting to be part of the accumulation process itself. The two roles have to be kept separate with the latter being beholden to the former. Where this does not occur, the current problems facing Enron and Arthur Andersen are the likely outcome.

[7] It will be interesting to see how this changes with the move to the dominance of the IASB in 2005 in Europe. The steering model does not change since it does not specify whether we are looking at a national or transnational societal model, but the change of emphasis from domestic to international accounting standards and whether this follows national or international lifeworld demands is an interesting question. It is one which the Habermasian model throws up but one which space precludes addressing in this paper.

Institute of Chartered Accountants in England and Wales[8] – and all the consequent activities that come with the process of attaining professional status.

However, as Napier and Noke (1991) indicate, the relation between the legal and accounting professions was 'uneasy' and remains so, with the former retaining its position as the dominant party. Most notable in this uneasy relationship is in the respective roles of law and accounting in the interpretation of the Companies Acts that specify the criteria concerning the design and construction of financial accounting statements. Central to this concern has been the interpretation of the legal requirement contained in the 1844 Companies Act that financial statements should present a 'true and correct view' which then, in section 13(1) of the Companies Act of 1947 (consolidated into section 149(1) of the Companies Act of 1948), changed to a 'true and fair view'.

It was not until the Companies Act of 1989 that there was any clear mention of the relevance of accounting standards for determining this 'true and fair view'. The wording in this Act leads McGee (1991:885) to the view that 'this provision adds something quite new' since:

> '...departures from the accounting rules in the Act are permissible only for the purpose of complying with the true and fair view requirement, whereas there is no such limitation in the cases of departures from SSAPs. Nevertheless the new provision creates a presumption that accounts shall be prepared in accordance with SSAPs by requiring any departure from them to be explained. This falls short of giving statutory force to the work of the ASB, but it clearly does give it statutory approval. The change will surely increase the weight given to SSAPs in the context of true and fair view (and possibly in other contexts as well) but it does not defeat the basic argument that SSAPs are only of persuasive force.' (McGee, 1991:885)

Thus, whether we refer to law and accounting as dealing respectively with 'form' over 'substance' (Freedman and Power, 1991; Macdonald, 1991) or 'formalism' over 'anti-formalism' (McBarnet and Whelan, 1991) or having 'statutory' or 'persuasive' force (McGee, 1991) there is no escaping that the 'true and fair view' '....test is a legal one, and cannot be a matter purely for accountants, however much they might wish otherwise' (McGee, 1991:887). Yet the Companies Act of 1989 '...makes it essential that the two professions should seek a better understanding of each other's approaches and perspectives' (McGee, 1991:888).

The accounting standard-setting bodies and the accounting profession more generally are subject to the ideological judgment as to whether they are working in the public interest, largely (we would argue) because of their potential effect on the economy, which government s are in being to protect in a capitalist society (Offe and Ronge, 1982). There are economic consequences that come with accounting processes. Where these accounting actions lead to perceived negative economic consequences then our view is that governments will seek to act to correct the situation.

2.3. Government tensions that led to the emergence of the self-regulatory bodies of accounting

There were two unique points in the history of accounting where government tensions and concerns were so great that had the accounting profession not acted the future role of the profession would have been in doubt. These concerns were so extensive that, rather than make marginal changes, a full-scale reshaping of the accounting regulatory framework became the only feasible solution.

Early in 1970 a new Accounting Standards Steering Committee (ASSC) was formed which, according to Robson (1991), came about as a reaction to various societal factors. Our thesis suggests that had this new body not been formed, the government of the time would have been required to act. Clarity as to the purpose of the new body was contained in the Institute of Chartered Accountants in England and Wales (ICAEW) Statement of Intent on Accounting Standards, produced in 1970, which promised:

1. Narrowing the areas of difference and variety in accounting practice.
2. Disclosure of accounting bases.
3. Disclosure of departures from established definitive accounting standards.
4. Wider exposure for major proposals on accounting standards.
5. Continuing programme for encouraging improved accounting standards in legal and regulatory measures. (ICAEW, 1970)

Robson (1991) highlights three major 'arenas' – where an 'arena constitutes a condition of possibility for the accounting change' (Robson, 1991:549) – in the formation of this major development for the accounting profession. First and foremost, he argued that during the late 1960s there was extensive growth in the industrial base, with numerous mergers requiring more sophisticated accounting information. Because this information was not available, a number of high profile scandals and incidents occurred. Notable among these were the GEC/AEI case and Pergamon-Leasco affair. These were, as Cooper and Rees (1995:362) suggest: '...caused by illegal activities far beyond the scope of audit involvement', yet accounting and audit were blamed for these economic disasters.

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[8] Now just one of the six UK professional accounting bodies.

The view of society was that the accounting profession was not fulfilling the function for which it was in being and, therefore, was perceived not to be working in the public interest. Such high profile scandals, demands and challenges could not have gone unanswered, and it is not too fanciful to assume that if the profession had not reacted in the way that it did then the government would have had to act. The accounting profession did, however, form the ASSC which Cooper and Rees (1995:362) argue not only seemingly solved the problem but also enhanced '...their professional standing' as an independent self-regulating profession.

A second incident is much the same as the first, and relates to the reformulation of the ASC (the renamed ASCC in 1976) into the Accounting Standards Board (ASB) in 1990. By the late 1980s similar problems started to re-emerge to those that existed in the 1960s. Notable scandals included the Guinness affair in 1987 and the Barlow Clowes problems in 1988. These financial scandals were again linked to the failure in accounting reporting leading to doubts whether the ASC really was working in the public interest. The profession's strategy was again to prevent any government intervention in solving these problems. To ensure this the Consultation Committee of the Accountancy Bodies (CCAB)[9] set up an independent review in 1987 headed by Sir Ron Dearing. The brief of this review was: '...to review and make recommendations on the standard-setting process'. The Dearing Committee reported in 1988 with a number of key recommendations including one to reformulate the ASC into the ASB with a new guiding Financial Reporting Council and Financial Review Panel which allowed external bodies, not least the government, to have a say and a view over the actions of the self-regulatory processes of the accounting profession. This was accompanied by a more seamless regulatory structure, involving government, law and the accounting profession, while maintaining the latter's professional judgment and self-regulation:

> 'For the first time the law was introduced into the standard-setting process. If the Review Panel concluded that revision to a company's accounts was required in order for them to comply with the Companies Acts to show a true and fair view, and the company concerned was unwilling to take action, then in extreme cases the Panel or the Secretary of State could initiate civil actions. The court in such an instance may order the company concerned to prepare revised accounts and circulate these to all persons likely to have relied on the previous accounts.' (Cooper and Rees, 1995:366)

2.4. *A summary comment*

These incidents demonstrate various attempts by the accounting profession to avert any doubts that it was working in the public interest. On each of the occasions highlighted there was a genuine doubt by the government as to whether some intervention was necessary into the self-regulatory processes of the accounting profession due to public interest failures. In each of these cases this involved the same strategy: the formulation and reformulation of self-regulatory bodies to demonstrate that the accounting profession could regulate itself, and that the public interest could be served by averting future major societal crises or needs through these structural changes.

The two instances discussed above led to major structural changes in the way the accounting profession was regulated. These were instances of government concerns related to public interest challenges and the reactions of the accounting profession to deal with such problems while maintaining its self-regulatory status. However, it is not just these major catastrophes where the government's public interest concerns are apparent. They also occur in relation to particular accounting standards. One of these is the main focus of this paper – accounting for PFI – and we now turn to the debates surrounding this in the next two sections. However, to reinforce the general claim – which is a central thesis of the paper – that this is not some unique event we also compare and contrast the debates surrounding accounting for PFI with those of the 1970s and 1980s related to a similar accounting problem related to accounting for inflation.

3. PFI and accounting: background and reasons for the conflict

3.1. *The emergence of PFI*

PFI is traceable to the autumn statement of 1992 when the then Chancellor of the Exchequer, Norman Lamont, announced its launch. Against a background of recession the chancellor set out to re-organise the framework of monetary policy (on the exit of the pound from the European Exchange Rate Mechanism), to control fiscal policy and limit public sector spending and to increase the growth rate of the economy. The latter was seen to be best achieved by '...pressing ahead with our policies on privatisation, deregulation, cutting out waste and keeping the tax burden of companies and individuals as low as we can', (Norman Lamont, House of Commons Hansard (HCH), 12/11/92, column (c) 994). In this context there was recognition of the ongoing need for capital improvements in the public sector. While the chancellor sought to give some protection to the provision of capital from public resources a major theme was the development of the 'private financing of capital projects' (Norman Lamont, HCH, 12/11/92, (c) 1998). Three developments were announced: that any privately financed project in the public sector which could be profitable should be allowed to proceed; that joint ventures which allowed a sensible transfer of risk to the private sector should be encouraged; and that leasing that permitted good value for money and for risk to remain with the private sector should also be allowed. These changes were to be the start of a developing policy which, in 1997, was adopted and taken forward by the new Labour Government.

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[9] Which itself had been formed in 1976 with the intention of reinforcing the standard-setting process but also seemingly to avoid the crises that led to the formation of the ASSC. Unfortunately, such mechanisms were not strong enough to avoid the further financial crises and scandals of the 1980s. But at least the CCAB had the wisdom to do something about these structural deficiencies – again, we would argue, because not to act would have led to the self-regulatory processes being withdrawn by the state on public interest grounds.

Arguably, until the introduction of PFI, infrastructure developments were either downplayed as a priority or assumed to be solved through the privatisation of parts of the public sector. Throughout the time in office of the previous Conservative Government, capital expenditure had been somewhat neglected even though the needs for infrastructure developments were considerable. Terry (1996:9) points out that this neglect was probably because capital expenditure tends to have a lower political priority and does not have the immediate impact that follows from not fulfilling revenue commitments (e.g. the immediate political backlash that comes from, say, reductions in social security benefits). However, the cumulative effect of under-investment in capital stock inevitably increases through time. Perhaps it was the reality of this pressing infrastructure need, alongside the equally pressing requirement to keep public expenditure under control, which, when coupled with an ideological commitment to involve the private sector in the public sector, led the Conservative Government to launch PFI in 1992. The solution to the infrastructure problem that had been adopted wherever possible by the Conservatives, prior to 1992, had been privatisation of the public sector. However, by 1992, the possibilities for privatisation declined, leaving the government with a need for new ideas to encourage private sector involvement in the public sector. PFI supplied this new idea.

The current Labour Government has not only embraced PFI but actually advanced its cause, despite it being an initiative of the Conservative Party with its potential to link into the privatisation of the public sector. PFI, to some in the Labour Party, is a form of privatisation and possesses all the problems that accompanied this Conservative Government policy. It is possible that it was this sensitivity that has given rise to the more generic (Labour) term of 'public private partnerships' (PPPs), of which PFI is one, but not the only, variant. However, the use of PPPs has been slowly gaining ground. PFI, remains the central and most highly developed, yet controversial, expression of PPPs.

PFI is an initiative of great complexity raising many issues and concerns. It has generated considerable financial capital investment of private sector money in the public sector. Approximately £7bn of capital had been raised from the private sector from the outset of PFI in 1992 to the general election on 1 May 1997 – £5bn of this had been in transport schemes (not least the Channel tunnel link (£3bn)). Since 1 May 1997, when the Labour Government was elected, there has been a step change in the amount invested through PFI, in a much wider range of different functional areas. By April 2003, 563 projects had reached financial close with a capital value of £35.5bn – some £28bn since the 1997 general election (cf. HMT, 2003:19).

3.2. Accounting for PFI: the main issues and reasons for tension

Immediately after the election of the Labour Government – in fact within a week of them taking office – an independent review of PFI was authorised under the direction of an industrialist, Malcolm Bates. Among the extensive range of recommendations included a requirement '...that the Treasury issue interim[10] guidance by 30 September 1997 on the accounting treatment of PFI transactions by public sector entities'. (HMT 1997, para. 2.1.1:2). As the report continued: 'The Treasury accepted this recommendation, recognising that uncertainty over the accounting treatment of individual transactions had been detrimental to the developments of PFI' (HMT, 1997, para. 2.1.2:2). The exact ways in which this lack of accounting clarity had 'detrimental' effects is not made clear. Yet HMT was of the view that the accounting treatment was significant and needed resolution.

The relevant accounting issue, in simple terms, is whether the property element involved in the PFI deal can be separated and whether, if it can, the resulting property is owned by either the public sector (and hence should appear 'on balance sheet' for the public sector) or the private sector supplier (and hence should appear 'off balance sheet' for the public sector). This seemingly innocuous question led to considerable differences of view between the ASB and HMT. To HMT, PFI contracts are to do with the procurement of services (with the property element being subsumed within these services) whereas to the ASB in all cases they involve a separate property element, thus making asset recognition (upon whose balance sheet should the property as an asset appear) of central importance.

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[10] The reason for the inclusion of 'interim' in this quote was presumably because Malcolm Bates was aware that the ASB was working on more 'final' accounting guidance. However, it is interesting that he proposed that the Treasury should have the first say on what should be done – even if it was only ever going to be 'interim'.

In the late 1990s HMT was concerned that PFI transactions should not appear on public sector balance sheets. This view appears to have been driven by three reasons.

First, because of the perceived connection of the accounting treatment to the judgment concerning value for money. As Heald (2003) makes plain, the accounting treatment is a separate judgment to that of deciding whether value for money is being achieved, even though through the risk analysis there is a connection. Yet in the mid-1990s this separation was not clear. If the PFI project was recorded as being on the public sector balance sheet there was a *perception* that the project was not achieving value for money. If it was not value for money then this would lead to an increase in the critiques of PFI which, in turn, would (it was supposed) make the private sector less willing to invest in PFI contracts. Thus there were perceived real economic repercussions with PFI transactions appearing on public sector balance sheets

Second, an established but not always clearly articulated view, was that if PFI transactions became assets on the balance sheets for the public sector, this would count as part of public debt which, to some, seemed to lead to macro economic problems, leading again to a perceived likely reduction in the uptake of this procurement route. The negative ramifications of adding to the old Public Sector Borrowing Requirement (PSBR) and public debt and its possible subsequent implications for the Maastricht Treaty (related to the conditions for entry into the European Monetary Union (EMU)) were of significance to those who held the view that having PFI transactions appearing on public sector balance sheets was something to be avoided (cf. Heald, 1997; Broadbent and Laughlin, 1999). An easy way out of this was to change the macro fiscal rules, which is exactly what HMT did in the late 1990s (HMT, 2002). The 'golden rule' and the 'sustainable investment rule' and the change to the five economic tests for entry to the EMU changed the sensitivities around the accounting for PFI. However, until these new rules were established – by late 1999 or early 2000 – the perception prevailed that if PFI transactions appeared on public sector balance sheets then this had negative macroeconomic consequences.

Third, there was a genuine fear in the mid 1990s that the change in government accounts, coming with Resource Accounting and Budgeting (RAB) (Likierman, 1995), and the introduction of clearly segregated capital and revenue Departmental Expenditure Limits (DELs), would mean that accounting for PFI as a capital item would reduce departmental options. This fear remains, despite recently introduced adjustments to DELs to cater for PFI transactions, should they appear on public sector balance sheets.

It was, thus, deemed to be in the public interest, as perceived by the Labour Government – or, rather, by HMT on behalf of Government – that PFI transactions should remain off the public sector balance sheets. Given the Government's role, using Habermasian terms, as a steering media it would have been irresponsible, given these perceptions, for HMT not to act to do what it could to ensure this outcome.

The ASB, in contrast, was deeply concerned in the late 1990s with the accounting implications of off balance sheet financing for capital developments. The ASB saw it as its responsibility to do whatever was possible to expose such forms of behaviour through tighter accounting rules. Not to do so would presumably have been seen as irresponsible and possibly run the risk of failing in its societal responsibility to act in the public interest. Accounting for PFI in any other way than one which gave a strong lead to recognising the property element as an asset to appear on one of the parties' balance sheets, would have seemed to be moving in an opposite direction to the ASB's perceived public interest duty.

4. Accounting for PFI: HMT and ASB guidelines

With these points in mind we consider how these different ways of thinking were expressed through the respective accounting guidelines.

4. 1. HMT Guidelines: Technical Note No. 1: How to Account for PFI Transactions (September 1997)

HMT introduces its 1997 guidelines by providing a '...series of tests to isolate those components of the transactions to which the remainder of this guidance should be applied'[11] (para. 5:3). HMT goes on to suggest that the guidelines:

- 'do not apply to underlying assets which provide no services to the procuring entity;
- should be applied to each component of the transaction for which both the service payment and the substance of the contract is separable; and

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[11] All quotes refer to HMT (1997).

- only applies to those components for which the initial capital cost of the underlying asset represents between 10% and 90% of the expected total service payments for that component in NPV terms.' (para. 5:3)

The decision tree then follows a question as to whether SSAP21 or FRS5 applies as well as how these standards should be applied. The important point to note is that, to HMT, if the PFI contract cannot be separated then the transaction would not be subject to either SSAP21 or FRS5. If separation is not possible the annual payments for the (inseparable) services would be accounted for in the normal way like any other current expense. To HMT this was deemed to be the case in the vast majority of PFI transactions since, in the main, these were for procurement of services under a contract that was technically non-separable.

If, and only if, the contract is separable then, as para. 5 points out, both elements of the contract need to be looked at in terms of a relationship between the capital cost of the underlying asset and the NPV of the total service payments:

- 'If the initial cost of the underlying asset is not significant (less than 10% of the NPV of the expected service payments) in the context of the transaction as a whole, then the procuring entity (NB the public sector body assumed to be procuring services) should not recognise the underlying asset.' (para. 9:4) in the capital element.(NB: SSAP21 or FRS5 does not apply)
- 'If the initial cost of the underlying asset represents the vast majority (more than 90% in NPV terms) of the total cost of the transaction the capital element is effectively a lease of the underlying asset and the accounting treatment of the lease should be determined under SSAP21.' (para. 10:4)
- If the initial cost of the underlying asset represents between 10% and 90% of the total cost of the transaction (in NPV terms) the capital element must be accounted for under FRS5 based on a risk analysis to determine whether the procuring entity should recognise the asset. 'The procuring entity should not recognise the underlying asset if the combined effect of the key risks exposes the operator's equity holders to real commercial risk over the operating phase of the contract.' (para. 13:5)

As is made plain:

> 'Interpreting the results of the risk analysis to determine if there is real commercial risk to the operator's equity holders will be a matter for professional judgement'.[12] (para. 31:11)
>
> 'In determining the substance of the PFI transaction, certain factors such as the intention of the parties should be considered to determine if this is consistent with the results of the risk analysis....If the supporting evidence assessed at this stage does not confirm the conclusions of the risk analysis then further investigation should be carried out to reconcile the apparently inconsistent findings.' (para. 33:13)

The effect of the original Treasury's guidelines was that few, if any, transactions fell within the guidance of SSAP21 and FRS5 since few were separable. Even when they were separable the risk analysis, in the main, would have prevented the possibility of asset recognition for the procuring entity (i.e. the public sector).

4.2. Accounting Standards Board (ASB) FRS5 Technical Note ED (December 1997)

The ASB maintained that a PFI contract is separable in more cases than the HMT suggests. More importantly, the analysis for separability is *not* to determine if there is any property element as with the HMT guidelines – it is accepted a priori that there is. The separability decision is to remove those elements of a 'pure service' nature from the contract and so concentrate on the remainder, which is taken to contain a property component. Thus, the criterion of separability is to find out what can be *excluded* from consideration under SSAP21 or FRS5. In the case of HMT's initial guidelines, separability was to find out what can be deemed to be *included* for consideration under SSAP21 and FRS5. As we have seen, according to HMT, if the contract cannot be separated there was nothing to include of a property nature.

What is left after the pure service element is excluded will be PFI contracts that fall under SSAP21 or FRS5:

> 'A PFI contract will contain a stand-alone lease (so that SSAP21, interpreted in the light of FRS5, should be applied) where:
>
> (a) the only elements remaining after excluding the separable service elements are payments for the property; and
> (b) these payments are either fixed or vary by a factor that is independent of the property (e.g. movements in general interest rates or general price levels).' (para. F13:10)

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[12] Interestingly, HMT's view that this is not some programmable activity and is, therefore, subject to 'professional judgment' is given even more emphasis, as we will see, in the revision to the guidance in 1999. However, as we also will see, the ASB gives little to no emphasis overtly within the ED or resulting standard to professional judgment. Given that FRS5 is in fact all about substance over form which is determined by professional judgment, it is clever and ironic the way the HMT has made transparent and foundational an analytical process with which the ASB shares, and with which they cannot, in the final analysis, disagree.

> 'In applying SSAP21, the key question is whether the lease is a finance lease, ie. one that "transfers substantially all the risks and rewards of ownership of an asset to a lessee". One indication of this is given by comparing the present value of the minimum lease payment with the fair value of the asset (often referred to as the '90 per cent test'). However, in many cases such a numerical test will not be required. The principal risks and rewards of ownership are usually demand and residual value. Where substantially all the risks and rewards associated with these lie with the purchaser, it will be clear, without performing any calculations, that the lease is a finance lease (i.e. that the property is an asset of the purchaser). Only where the operator bears significant risk will a 90% test be required.' (para. F15:11)

The ED continues:

> 'Even where a 90% test is used, it is important neither to apply this as the only test nor to apply a 90% cut-off in a mechanistic way. The overriding principle is to establish whether the purchaser has substantially all of the risks and rewards of ownership.' (para. F16:11)

> 'Other PFI contracts will fall directly within FRS5. These will include those where:
>
> (a) there are some non-separable service elements; or
> (b) the PFI payments vary with factors such as usage of the property or a specific index that reflects the operator's costs.' (para. F14:10)

> 'For those cases that fall directly within FRS5, whether a party has an asset of the property will depend on whether it has access to the benefits of the property and exposure to the associated risks. This will be reflected in the extent to which each party bears the variations in profits (or losses) relating to the property and any non-separable services.' (para. F20:12)

Of these, the view is that demand risk (the risk that demand for the property will vary relative to expectations) is possibly the most telling: 'Where demand risk is significant, it will often give the clearest evidence of who should record an asset of the property'. (F23:13). The ED also gives special mention to residual value risk (see quote from F16 above) but then do not make further claims in the specific sections dealing with this risk (F43 to F47).

4.3. Accounting Standards Board Amendment to FRS5 Reporting the Substance of Transactions: Private Finance Initiative and Similar Contracts (September 1998)

Despite some unprecedented challenges during the ED consultation period – including a comprehensive and robust commentary by HMT[13] (see Broadbent and Laughlin (2002) for more details on these responses) – changes to the resulting Standard were marginal. Apart from some relaxation of the somewhat unequivocal stance that separability is clear and likely in most circumstances, the ASB's amendment to FRS5 largely follows the content of the December 1997 ED.

Apart from some slight loosening of when contracts are separable, it still leaves *all* contracts to be considered under either SSAP21 or FRS5. The rules for applying SSAP21 and FRS5 remain almost unchanged from the ED. With regard to SSAP21, the rules discussed above (taken from F15 and F16 of the ED) are reproduced verbatim in F14 and F15 of the FRS5 Amendment. Likewise, the rules for applying FRS5 (from F20–F22 in the ED) appear using virtually identical wording in F19 and F22 of the FRS5 Amendment.

In the standard as in the ED, asset recognition is determined by 'variations that flow from the features of the property':

> 'For those contracts that fall directly within the FRS, whether a party has an asset of the property will depend on whether it has access to the benefits of the property and exposure to the associated risks. This will be reflected in the extent to which each party bears the potential variations in property profits (or losses). The principle here is to distinguish potential variations in costs and revenues that flow from the features of the property – which are relevant to determining who has an asset of the property (see paras F22–F50) – from those that do not – and which are therefore not relevant to determining who has an asset of the property...[T]here may be features that could lead directly to profit variations for reasons that relate purely to service. Such variations may take the form of potential penalties for underperformance, or potential variations in revenues or in operating costs. These should be ignored when assessing who has an asset of the property, irrespective of their size'. (paras. F19 and F20:12)

The list of risk areas in the standard remain the same as those highlighted in the ED to the standard. There is still a concentration on the significance of demand risk, yet there is a greater emphasis on residual value risk:

> 'Demand risk is the risk that demand for the property will be greater or less than predicted or

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[13] It is rare to see HMT *directly* commenting on EDs. The fact that they did so in this case, and the more detailed content of their comments, gives indication of the strength of feeling that HMT held (holds?) concerning the ASB's views.

> expected. Where demand risk is significant, it will normally give the clearest evidence of who should record an asset of the property.' (para. F24:14)
>
> 'Residual value risk is the risk that the actual residual value of the property at the end of the contract will be different from that expected...Where it is significant, residual value risk will normally give clear evidence of who should record an asset of the property.' (para. F44:21)

Finally, it is important to note that the amended FRS5 arguably applies only to the private sector. This is not made plain in the standard; but in many ways this is because the ASB's authority does not technically extend to the public sector. This delicate matter was made plain in the ASB's press notice to the launch of the Amendment to FRS5, but with it something of a reminder as to how it was expected HMT might act:

> 'The requirements of the ASB's accounting standards apply primarily to the private sector. Last year the Treasury issued provisional guidance on public sector accounting for the PFI, but said that it expected to adopt the ASB's standard when it was issued. It is for the government to decide how the Application Note should be implemented in the public sector.' (ASB Press Notice 122:3)

4.4. HMT Guidelines: Technical Note No. 1 (Revised): How to Account for PFI Transactions (June 1999)

Geoffrey Robinson (Paymaster General and minister in charge of PFI) '...accepted[14] the principles published by the ASB' (HM Treasury News Release 146/98, 9 September 1998 as with the following quotes) and that he was 'putting in hand preparation of new guidance that will apply these principles in a way that will ensure consistency and cost-effective compliance throughout the public sector'. He also made plain that there would be '...no retrospective changes to signed deals and those out to Best and Final Offers will not be affected'. Above all, it was the view of HMT that they did '...not expect capitalisation judgments to change greatly and that the private sector contractor's ownership of assets will in most instances continue to be recognised.'

In June 1999 the new guidelines were issued. They were an 'interpretation' of the ASB's standard – '...to ensure the overarching principles of the AN[15] are consistently applied' (para. 1.4:1).[16] The guidelines are '...mandatory for all bodies preparing their financial statements in accordance with the Resource Accounting Manual' and '...mandatory for Non-Departmental Public Bodies, Trading Funds, NHS Trusts and those Public Corporations that prepare their financial statements in accordance with an Accounts Direction issued with the approval or consent of the Treasury' (para. 1.7:3). However, and again registering a continuing uncertainty about the rights and responsibilities of the ASB, they point out that it '...is a matter for CIPFA/LASAAC[17] Joint Committee to determine the status of this guidance for Local Authorities.' (para. 1.7:3).

The unwritten intentions of the guidelines are clear – to try to ensure that, following the interpreted rules, PFI transactions will remain off public sector balance sheets. This was likely to be possible with new deals, since the plan was to have the accounting rules at the forefront at all stages in the negotiation stages. However, the guidelines are at pains to emphasise that it is not the accounting that should be driving PFI decisions:

> 'The objective of PFI procurement is to provide high quality public services that represent value for money for the taxpayer. It is therefore value for money, and not the accounting treatment, which is the key determinant of whether a project should go ahead or not. Purchasers should focus on how procurement can achieve risk transfer in a way that optimises value for money and **must not** transfer risks to the operator at the expense of value for money.' (para. 1.9:3) (emphasis in the original)

This subtle shift in the language indicates clearly what is perceived to be in the public interest. It is whether or not the PFI project gives 'value for money for the taxpayer'. It is also interesting to note that even in these new guidelines there is an increasing distancing between the accounting treatment and this judgment.

A major difficulty arose with the need to re-evaluate PFI deals retrospectively according to the new accounting rules – even with the 'interpretation'. At a logical level it should not make any difference – if a previous PFI contract was deemed to be originally 'off' balance sheet then the assumption was that, with the new guidelines, a similar accounting treatment would be the outcome. Yet rules are not absolutes but, rather, are socially constructed. Change the rules and what was originally thought to be 'off' balance sheet could change. This was the fear of HMT which was being required to undertake a retrospective analysis of all the 250-plus

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[14] Although it is difficult and probably inappropriate to read too much into formal public announcements there is a distinct feeling that this acceptance was far from being with enthusiasm...

[15] AN stands for Application Note which is how the 1998 Standard – ASB (1998) – is referred to by HMT.

[16] All quotes HMT (1999).

[17] CIPFA/LASAAC stands for the Chartered Institute of Public Finance and Accounting and the Local Authority Scottish Accounting and Auditing Committee.

PFI contracts that had been signed. This is not explicitly stated in the guidelines, although more than a hint to this issue is given: '...the AN makes clear that the provisions of the AN should be applied in private sector financial statements relating to the accounting periods ending on or after 10 September 1998, which requires the accounting treatment of all previous PFI transactions to be reassessed under the AN.' (para. 1.0:3). Careful application of the interpretation was needed if it was not to appear that these past transactions were reversed in terms of their balance sheet treatment. At the time, such a reversal, it was feared, could lead to the perceived view that the PFI contracts in question were not now generating value for money.

Central to the guidelines is the provision of a practical way to undertake an analysis of risk transfer arrangements, since this is a major factor in deciding asset recognition. The starting point is para. F19 and F20 from the ASB's standard in relation to the 'potential variations in property profits (or losses)' that 'flow from features of the property' that need to be investigated to judge asset recognition. The guidelines take the seven areas of risk listed in para. F22 of the ASB's standard (which provides a focus for deciding who bears these risks and the consequent profit variability that flows from this), and how they can be calculated.

HMT begins this analysis by pointing out that what appears to be clear to the ASB is not necessarily so:

> 'The AN also provides that: where demand risk is significant, it will normally give the **clearest** evidence of who should record an asset of the property, and where it is significant, residual value risks will normally give **clear** evidence. However, it will not always be the case that demand and residual value risk are significant and therefore, where they are not significant, these risks will not necessarily give the clearest (or clear) evidence of who should record an asset of the property.' (para. 4.10:14) (emphasis in the original)

Issues about 'significance' are central at this point. To HMT, however, this is not some programmable activity but one that is more subjective and dependent upon what is referred to as 'professional judgment':

> 'Determining the substance of transactions is a matter of professional judgment which involves the weighing up of all relevant indicators (both qualitative and quantitative) of which party has an asset of the property. In some cases, however, following an initial assessment of the risks of the transaction, some risks may be found to be of such overwhelming significance that it will not be necessary to perform further detailed work because it will be obvious which party has an asset of the property. Conversely, where the accounting treatment is not immediately obvious, further detailed work will be required.' (para. 4.3:12)

The guidelines suggest that *both* qualitative and quantitative information be used to provide a base for this professional judgment. There is a constant reminder not to rely on 'spurious' measures and information to provide automatic judgments for decisions that replace professional judgment:

> 'An important point to consider when undertaking a quantitative risk analysis in a PFI context is the danger of spurious accuracy, i.e., that the results could be misinterpreted as implying a degree of accuracy that is not warranted because of the limitations of the inputs into the model. Given the inherent assumptions and judgments underlying such a quantitative risk analysis, it is important not to apply a model in a mechanistic way. The validity of the results of the quantitative risk analysis will depend on the accuracy, certainty and completeness of the inputs and the assumptions made in relation to those inputs. Therefore, when forming an overall judgment on the accounting treatment, the results of the quantitative risk analysis should always be assessed together with:
>
> - those risks that are not quantifiable, i.e. the qualitative indicators...and
> - those risks which, depending on the circumstances of a particular case, may not be capable of meaningful quantification for inclusion in the quantitative risk analysis due to the level of uncertainty surrounding them. The potential impact of these risks on the overall judgment will therefore need to be carefully considered and properly justified.' (para. 4.5:12/13)

The new HMT guidelines, therefore, provide an interpretation of the ASB's standard that involves recognition of the important subjectivity and the role of professional judgment in arriving at views concerning asset recognition. It is a reminder, if a reminder is needed, that the interpretation of any standard is not some self-determining programmable activity but one that is riddled with subjectivity and uncertainty, reliant on professional judgment.

4.5. Some summary thoughts

The initial HMT guidelines had rules, which left only a minority of transactions to be considered under SSAP21 and FRS5. Their revised guidelines accept the ASB's judgment that all need to be viewed in the light of these standards but make clear that decisions on asset recognition is a

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process heavily dependent upon professional judgment rather than determined by a defined formula. This, coupled with the requirement of the guidelines that the accounting treatment should be borne in mind during the decision making process, has resulted in a large number, but certainly far from all,[18] PFI transactions remaining off public sector balance sheets.

The ASB's ED and standard, however, have been more consistent in terms of emphasis. To the ASB, all PFI transactions fall within the accounting considerations of either SSAP21 or FRS5. This is partly because of a more stringent understanding of what is a separable contract, even though the rather harsher criteria in the ED was modified to some extent in the final amended standard. The judgment on separability is only to find out what should be *excluded* from consideration under SSAP21 and FRS5 – and, even if a contract is not separable, FRS5 immediately is brought into consideration. It is only the 'pure' service element that can be *excluded*. The ASB also has rather more apparently[19] exacting rules as to whether either the separable or even inseparable contracts are actual financing leases (under SSAP21) or, in substance, financing leases (under FRS5). The underlying, admittedly unstated, expectation was that the majority of PFI transactions were of this sort and should, following the rules, appear on public sector balance sheets.

The intense interest in this accounting treatment is because of its perceived economic consequences for the development of public sector services. To the Government, the public interest is served if a PFI transaction generates value for money. The Government's view (which was starting to change even during the production of HMT's 'interpretation') was that value for money would not be seen to be achieved if PFI transactions appear on public sector balance sheets. If not *seen* to be achieved then the PFI alternative could be abandoned, or at least reduced as a priority. Equally, a PFI transaction appearing on any public sector accounting unit's balance sheet will count against capital spending limits, reducing the pursuit of other capital investment possibilities. Put simply, there were perceived (and real) economic consequences for trying to ensure an off-balance sheet treatment. Seemingly it was the government's view that the ASB's standard, and the accounting rules this contains, makes these economic consequences likely. An alternative view is that it was enough of a likelihood that a complex and subtle 'interpretation' was deemed to be necessary to reduce this possibility. The interpretation was one which worked within the standard, perhaps not the way the ASB intended – or with the intended outcome.

What is interesting about this case is that the government, via HMT, decided against a *direct* confrontation with the ASB. Instead, a more subtle form of resistance through what we might call 'interpreted' compliance was deemed necessary. HMT was reluctant to instruct the ASB what it should do even though it gave a strong lead in 1997, following the encouragement of the Bates Report to provide this (admittedly interim) direction. The ASB was unwilling to adopt this strong lead, but the Government was also unwilling to undermine the self-regulatory authority of the ASB. However, the Government was in strong disagreement with the ASB as to the proposed accounting treatment. It required more subtle forms of behaviour to allow the Government to achieve its end result. The important point to note is that this was driven by public interest arguments. To the Government, it was perceived to be in the public interest that PFI transactions should remain off public sector balance sheets. If this did not occur the perceived view was that substantial negative economic consequences, in different forms, would be forthcoming.

5. Exploring the public interest concerns in PFI and inflation accounting: tracing similarities and differences

Similar government tensions also occurred in a rather dramatic and public disagreement in the

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[18] As the recent report from the HMT (HMT (2003) para. 2.26:24) indicates 57% of all PFI transactions are 'on' public sector balance sheets, although there are no details as to how this figure has been calculated. The unsubstantiated rumour is that the costs of the London Underground for its on-balance sheet treatment are included in these figures and given the size of this amount rather dominates this percentage figure. Another factor that may play a part in this percentage is that it includes a number of early, smaller, simpler PFI projects. Since these generated little value for money, HMT insisted that they be placed on public sector balance sheets as assets. HMT are now purposefully distancing themselves from any accounting treatment – 'Accounting and reporting treatment follows rules set by a series of independent national and international organisations, and is decided by independent auditors' (HMT (2003) para. 2.26:24). This seeming indifference is driven by making clear that the balance sheet treatment has nothing to do with the value for money judgment – '...it may be that a PFI contract delivers value for money through transferring significant risk to the private sector, but that the accounting principles require the public sector to score the property concerned on its balance sheet' (HMT (2003) para. B24:121). No such indifference was apparent in the late 1990s but was starting to be clarified in and through HMT's 1999 interpretation, as indicated previously.

[19] This is only the apparent situation. The ASB's standard looks like a programmable set of rules yet further probing suggests otherwise. Rather, as the HMT guidelines demonstrate, 'professional judgment' is needed to interpret these rules. As footnote No. 12 indicates, HMT made much of this in their interpretation. Given the UK accounting profession's proud support of 'substance over form' arguments, any disagreement by the ASB with the importance of professional judgment becomes difficult, if not impossible, no matter what they might think of some of the respective detailed aspects of the interpretation.

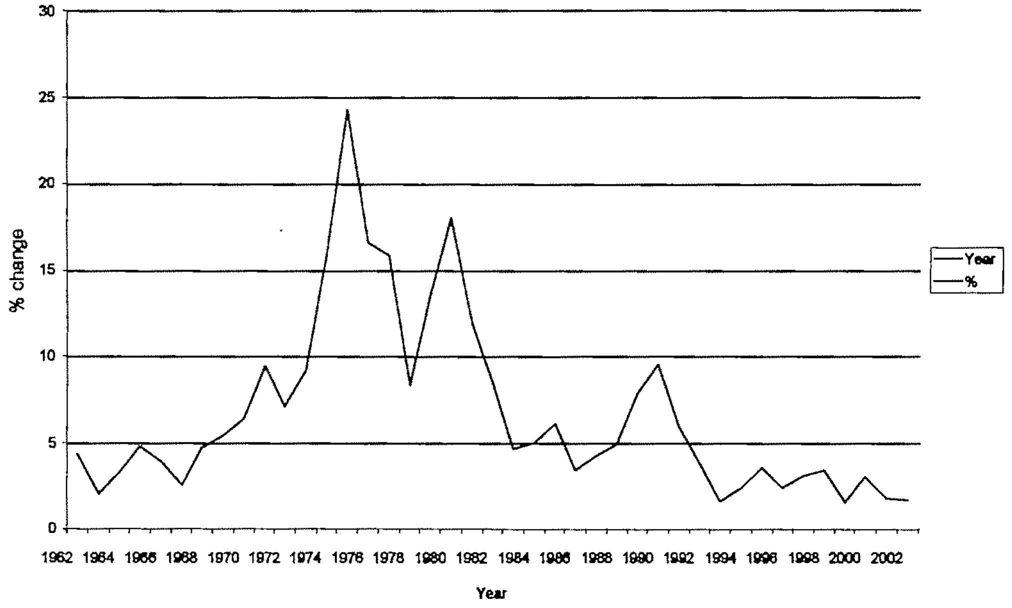
Table 1
Chronology of events of the inflation accounting debate

January 1973	ASSC, ED8 'Accounting for the Changing Purchasing Power of Money' published recommending CPP
July 1973	Comments on ED8 ends
July 1973	Government announces formation of 'Inquiry on Inflation Accounting'
January 1974	Government inquiry on inflation accounting starts work under chairmanship of Francis Sandilands
May 1974	ASSC, PSSAP 'Accounting for the Changes in the Purchasing Power of Money', based on ED8, published
July 1975	ASSC, 'The Corporate Report' published
September 1975	Government, 'Report of the Inflation Accounting Committee', recommending CCA, published
November 1975	CCAB, 'Initial Reactions to the Report of the Inflation Accounting Committee (The Sandilands Report)', published recommending the ASC will develop a new Standard based on CCA
January 1976	ASSC, IASG formed under chairmanship of Douglas Morpeth
November 1976	ASC, ED18 'Current Cost Accounting', published
July 1977	ICAEW, forced by Special Meeting resolution (put forward by Martin Haslam and David Keymer) to make CCA non-compulsory
July 1977	Government, Green Paper on 'Future of Company Reports', based on The Corporate Report, published
August 1977	'Price Level Accounting – Statement of Intent by the Accounting Standards Committee' published and formation of Workgroup to form 'Interim guidelines' under chair of William Hyde
November 1977	ASC, 'Inflation Accounting: An Interim Recommendation', the 'Hyde guidelines', published
November 1977	IASG announces that a new ED will be developed to be published in spring 1979
April 1979	ASC, ED24 'Current Cost Accounting', published; ED18 formally withdrawn
October 1979	Comments on ED24 ends
March 1980	ASC, SSAP16 'Current Cost Accounting', to be reviewed in three years time, published
July 1982	Haslam and Keymer call further ICAEW Special Meeting to propose withdrawal of SSAP16. Proposal defeated only narrowly.
November 1983	Major research reports published and summarised by Professor Bryan Carsberg claimed (controversially) to support the development of CCA
December 1983	Statement of Intent to revise SSAP16
July 1984	ASC, ED35 'Accounting for the Effects of Changing Prices', published
December 1984	Comments on ED35 ends
December 1984	ICMA and ACCA veto ED35; universal rejection of ED35 by industry
March 1985	ED35 abandoned
June 1985	SSAP16 made 'non-mandatory' due to non-compliance by industry
September 1985	New ED38 on Inflation Accounting drafted but not published due to lack of agreement by Government to provide statutory backing to ensure compliance
September 1986	CCAB (ex the ACCA who push for statutory backing) agree to withdraw SSAP16 due to continuing decreasing compliance
September 1986	ASC, Handbook on 'Accounting for the Effects of Changing Prices', published containing non-mandatory accounting advice for large industrial organisations facing inflation

Key:

ACCA	Association of Certified and Corporate Accountants
ASC	Accounting Standards Committee
ASSC	Accounting Standards Steering Committee
CCA	Current Cost Accounting
CCAB	Consultative Committee of Accounting Bodies
CPP	Current Purchasing Power (Accounting)
IASG	Inflation Accounting Steering Group
ICAEW	Institute of Chartered Accountants in England and Wales
ICMA	Institute of Cost and Management Accountants
PSSAP	Provisional Statement of Standard Accounting Practice
SSAP	Statement of Standard Accounting Practice

Figure 1
Percentage changes in retail prices indices 1962–2002



Source: UK National Statistics (http://www.statistics.gov.uk/STATBASE/tsdataset.asp?ulnk=229)

1970s and 1980s surrounding accounting for inflation. While the inflation accounting incident rightly can be seen, at one level, as both extraordinary as well as seemingly unique, our argument is that this was another incidence of the general thesis that we are advancing: namely, that where the UK government perceives that the public interest is not being achieved, then it is likely that it will act to correct this situation. In the case of inflation the public interest concern was that it was perceived that historic cost accounts would increase cost-push inflation rather than reduce it. We would argue that it is likely that such a concern would have led to a reaction by the accounting profession to recognise and resolve this perceived economic problem in such a way as to maintain the profession's self-regulatory role. In addition, our expectation is that the government would have sought to achieve its perceived public interest purpose even whilst allowing, as far as possible, the self-regulatory processes of the accounting profession to remain intact. Our argument is that accounting for inflation, as with accounting for PFI, demonstrates this thesis.

5.1. Overview of the inflation accounting debate

The inflation accounting debate is a long and complicated story continuing over decades, but with considerable intensity during the period from 1973 to 1986.[20] This paper cannot give justice to all the ramifications of such a lengthy and acrimonious debate. Inevitably, therefore, the following has to be selective. Nevertheless, Table 1 provides a summary of the main events of this debate.

Before providing a brief summary of the contents of Table 1, it is worth reflecting on the changing levels of inflation that occurred around the time of these debates. Figure 1 provides this detail. It traces the percentage change in the retail price indices for the period from 1962 (about the time when the ICAEW showed concern about inflation) to 2002 – some 16 years after the last time the ASC – as the ASSC was renamed in 1976 – actively did anything with regard to accounting for inflation. Comparing Table 1 and Figure 1 reveals that the periods when inflation was at its highest were also the times when there was the most frenetic activity in relation to trying to form an inflation accounting standard.

The debate surrounding accounting for inflation is whether to adjust the historic cost financial accounts to reflect a general change in the value of money, or to change the value base of the contents of financial accounts to reflect specifically-indexed current costs. The former, called Current Purchasing Power (CPP) accounting, invariably results in a supplementary statement to historic costs and was originally the ASSC's and the ASC's preferred accounting treatment. The latter, called Current Cost Accounting (CCA), involves a major change in the way assets and liabilities are valued and the profit (or loss) is calculated. A full form of CCA involves a fundamental shift away from historic cost accounting. It was the preferred alternative by the UK's government in the early 1970s.

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[20] As Mumford (1994) perceptively points out, this cycle of concern was not dissimilar to one that occurred in the 1940s. It was different in some ways however because of the perceived role of accounting reporting in aggravating cost-push inflation. Yet as Mumford suggests, apart from finding a new 'scapegoat' to blame, the cycle of events discussed below are not dissimilar to those in the 1940s.

The disagreements surrounding these alternative forms of accounting were extensive and heated, as Table 1 indicates. The ICAEW, before the ASC had been formed, was already well advanced in its thinking. Its accumulated experience and views were published in 1968, making a strong case for CPP accounting (ICAEW, 1968). This was followed by the (ASSC) Exposure Draft (ED) no. 8 in 1973, which built directly on this publication. Just before the end of the period for commentary on the ED (July 1973), Peter Walker, the secretary for trade and industry, announced that the UK Government was to conduct an inquiry into inflation accounting under the chairmanship of Francis Sandilands. Following extensive consultation with the Government it was decided, nevertheless, to proceed, in May 1974, with a provisional Statement of Standard Accounting Practice (PSSAP) no. 7 – the only provisional statement that has ever been published – based on ED8.

Meanwhile, and not unconnected with this disagreement, the ASC was working with various academics and practitioners to produce a far-reaching, theoretically-informed perspective on the future of financial reporting. The result of this was contained in *The Corporate Report*, published in July 1975 (ASSC, 1975). This publication was built on a stakeholder/user needs model and, among its many wide-ranging recommendations, included support for *both* CPP *and* CCA – the use of either or both being dependent on the respective information needs of users.

The Corporate Report was somewhat overshadowed by the final publication of *The Sandilands Report* in September 1975 which came out strongly in favour of CCA. The Consultative Committee of Accounting Bodies (CCAB) responded to this report, accepting that a CCA (rather than CPP) Standard needed to be produced and offered to develop this in the light of the contents and recommendations of the Sandilands Report. This was given government approval and a new Inflation Accounting Steering Group (IASG) – a new subcommittee of the ASSC – was formed in January 1976 under the chairmanship of Douglas Morpeth.[21] The outcome of what was considerable frenetic activity by the IASG, was the publication by the ASC in November 1976 of the longest ED ever published – ED18.

The pathway through to the end of this saga was fraught, involving rebellion by, first, the profession and then later by industry. Such was the professional concern that two chartered accountants from Sussex (Martin Haslam and David Keymer), managed to obtain enough support to call a Special Meeting of ICAEW members in July 1977, which ended with a vote in favour of making CCA, in the form specified in ED18, non-compulsory. The ASC, seriously damaged by the result of the ICAEW's vote, agreed to produce some interim guidelines through a new workgroup chaired by William Hyde. On publication of the Hyde guidelines in November 1977, the ASC announced that it would be producing a new ED on inflation accounting. This it did in April 1979, with the publication of ED24, which built on the simple rules provided through the Hyde guidelines. At the same time the much maligned ED18 was formally and finally withdrawn. In March 1980 SSAP16, based on ED24, was published with a view that, while not interim, it should be reviewed after three years. There were also considerable concerns about SSAP16 from all sides, leading again to another Haslam and Keymer-led Special Meeting of the ICAEW to vote to ensure, in effect, the withdrawal of SSAP16. This proposal was only narrowly defeated but had highlighted a major divide in the profession, which could not be ignored. This meant that the continuation of SSAP16, once the three-year review had been completed, would be doubtful. In December 1983, spurred on by some academic research support, the ASC agreed that it would revise SSAP16. This led to the development of ED35 issued in July 1984 as the basis for a new standard to replace SSAP16. ED35 was greeted with unparalleled disapproval from industry as well as from two of the professional bodies which were part of the CCAB. Such was the ferocity of the attack that ED35 was abandoned in March 1985.

This was followed by an announcement in June 1985 that SSAP16 would be made non-mandatory largely because so few industrial companies were producing supplementary statements built on its requirements. There was, in short, a crisis of compliance in relation to SSAP16. In September 1985 a new ED38 was developed, in the hope of trying to find a workable alternative to SSAP16, yet this was never published since the view was that, due to the compliance problems of SSAP16, the ASC was not prepared to continue to produce EDs and SSAPs unless the Government was willing to provide statutory backing to ensure compliance. This assurance was not given, and ED38 was never published. In September 1986 the CCAB (excluding the Association of Certified and Corporate Accountants which was still pushing for statutory backing to reinforce compliance) withdrew SSSP16, and a new handbook was published containing non-mandatory advice to companies facing inflationary pressures.

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[21] Interestingly, Douglas Morpeth was also chairman of the ASSC who designed and published PSSAP7, which advocated CPP accounting. Exactly how he coped with this major change of emphasis remains unclear.

5.2. *Inflation accounting and PFI: explicating commonalities and differences*

The inflation accounting story provides an extraordinary rich array of tensions surrounding the formation of a standard on a particular accounting issue. Our purpose is to use the story of this accounting issue to illustrate the major thesis of this paper about the public interest concerns of government. We also wish to illustrate how, by comparing this with the PFI debate, the expression of this ongoing concern can take different forms depending on time, issue and power related factors. In the following we analyse the inflation accounting debate in the context of three key questions: first, why did the Government become involved? Second, how did the profession react to this involvement? And third, what was the final outcome and the views of Government to this outcome? This will form the base from which a number of comparative comments will be made in relation to PFI and inflation accounting.

5.2.1. *An analysis of the inflation accounting debate*

Our starting premise is that the Government's involvement in inflation accounting was driven by economic concerns that the public interest would be better served by CCA rather than CPA. As Figure 1 indicates, inflation was a real problem in 1973 when the Sandilands Committee was formed. It was even more of a problem when the committee finally reported in 1975 – in fact 1975 was the year when the highest annual change in the retail price index since the Second World War occurred. As Robson (1994) makes clear, inflation brings with it considerable problems and pressures on wage levels, investment decisions, taxation and industrial development more generally. Something had to be done, and the government of the day was not convinced that CPP was the solution:

> Reading between the lines one suspects that the appointment of this committee stems less from a new found interest in accounting theory than from apprehension at the wider implications of ED8.' (Commentary, *Accountancy*, September 1972:4)

This concern was related to the divestment implications of CPP, which Bryer and Brignall (1985) conjecture as the major reason for government action:

> 'It was only at this stage – with CPP under fire from the investing community and rapidly rising inflation – that the government intervened. Announcing its inquiry, the minister alluded to the key question of divestment. Inflation accounting, he said, involved issues much broader than pure accounting matters. The committee would 'take into account a broad range of issues including the implications for investment and efficiency; allocation of resources through the capital market; the need to restrain inflation in the UK.' (Bryer and Brignall, 1985:32)

This concern with (dis)investment was applicable to internal as well as external investment control strategies that led to pressure on the government of the time to act. Whittington (1981), quoting correspondence with Douglas Morpeth, makes plain:

> '...of the companies who commented on ED8, only one-third supported CPP and the remaining two-thirds were divided between replacement cost accounting and other methods and there were indications that the government had been lobbied by a number of companies against the introduction of a CPP standard, I think on the grounds that CPP, since it depended on a general measurement of consumers' purchasing power of inflation, did not give the relevant information for use in managing their business.' (Whittington, 1981:71)

What this indicates is that, to the Government, inflation accounting had important economic ramifications in times of high inflation and CPP was not the solution to these difficulties. Lurking in the background of this altruistic public interest view, however, is pressure from industrial companies. Whether the Government would have still acted without this pressure cannot be known.

The profession's response was to fall into line with the CCA proposals but to point out the need for the profession to 'interpret' these requirements. What the ASSC did not anticipate was the difficulty this would cause because of both professional rejection of the proposals and a steady decline in the compliance to the resulting regulations. The professional response was part based on its own perception of public interest arguments. For instance David Richards, president of the ICAEW in 1980, in this vein made plain that:

> '... historic cost accounting has an unfortunate tranquillising side-effect in not a few boardrooms. The historic cost figures often look good – on paper – and they tend to induce a boardroom euphoria. It is only when these figures are adjusted for the effects of the diminishing pound that the more realistic picture of the past per-

> formance of the company begins to emerge.' (Leader, *Accountancy*, April, 1980:1)

However, an alternative public interest argument – and one which did not fall into line with Government views (unlike the above) – was also apparent in a substantial segment of the profession. This was well captured in the views of Martin Haslam, who was such a powerful dissenting voice:

> 'Governments cause inflation, and it is up to the government to reduce inflation through control over money supply and its own spending,' said Mr Haslam. The profession was too much influenced by the government of the day – 'we are not an arm of Government'. Inflation accounting would institutionalise inflation, and probably perpetuate it.' (*Accountancy*, August, 1977:5)

A more pragmatic response was out of fear of a Government takeover leading to an end to self-regulation:

> 'Nevertheless, what we have been witnessing in the past few months is the sculpturing and the insertion of the thin edge of a very thick wedge. It could lead, unless we are very careful, to a takeover by the Government of the initiative and the responsibility for determining accounting Standards. The possibility of a British 'Securities and Exchange Commission', or something even worse looms menacingly upon the horizon.' (Leader, *Accountancy*, January, 1976:1)

Or again:

> 'Sandilands proposed CCA. We were given the task of implementing it. If we fail, others will take on the task.' (Leader, *Accountancy*, June, 1977:1)

Arguably, it was this fear that drove the ASSC and subsequently the ASC to keep trying despite the difficulties involved in securing agreement.

The final outcome from this long and tortuous 13-year journey was no standard. An important question is: why this end point was reached and why the UK Government chose not to interfere again? In a somewhat perverse twist of events, given the history of inflation accounting, the ASC, in 1985, appealed to Government for statutory backing for any further inflation accounting standard. This followed the almost complete breakdown in the willingness of industrial companies to comply with SSAP16. In 1985 it seemed the ASC was trying to demonstrate that it had done everything it could to get a workable standard, based on Sandilands, but was fundamentally hampered if companies would not comply. The ASC's response, with its call for statutory backing, could, at one level, be read as testing the waters to see whether the Government was planning to intervene again. It did not.

Despite being not too impressed with the way the accounting profession had handled the matter over the years, the Government did not act because it did not need to. Something of this disappointment became apparent when this plea for statutory backing was made. As was made clear in the editorial of *Accountancy* in February, 1985:5:

> '....any move towards statutory backing would have far-reaching implications for the profession, particularly in the light of its arguments in defence of self-regulation.
>
> But government sources have indicated that the proposal for statutory control is not being pursued.
>
> There is known to be disappointment in government circles about the profession's failure to achieve consensus on inflation accounting. However, the government is believed to view the prospect of direct control as 'anathema'.
>
> Peter Godfrey, ASC chairman, has voiced his opposition to such control. 'I would be unhappy to see one standard picked out for statutory backing, and the rest left out. We are unlikely to see any government move at present.'

Our view is that, in general, government would prefer not to interfere at all but to delegate day-to-day responsibility. Its preference is to leave self-regulation to continue uninterrupted as long as it is working in whatever is currently perceived to be the public interest. Only when this is perceived to be breached is it duty-bound to act. In the case of the inflation accounting issue, SSAP16 had probably done enough to tide over the major problems of the years of high inflation. In addition rising inflation levels were no longer occurring and, therefore, the problems of historic cost accounting were not as acute. Above all else, industrial companies were no longer lobbying Government for change – in fact they did not want anything further to do with inflation accounting. To make them comply with something that was increasingly seen as irrelevant would have been a serious economic nonsense.

This raises an interesting question as to whether the governments of the time were being driven by public interest arguments coming from the societal lifeworld demands, as Habermas proposes, when they were giving expression to concerns arising from industrial companies. This would suggest that sectional interests were seen as important in order to maintain a capitalist society (Offe and Ronge, 1982) or legitimate capital enterprise (Sikka and Willmott, 1995). *Prima facie*, industry's concerns were the main driving force for the change in this inflation accounting concern. Nevertheless, care needs to be taken before assuming that the government was not steering according to overall societal lifeworld demands. We cannot address this value judgment here, although it remains an important concern. We can, however, make some comments on perceptions at the time. The Government *perceived* that it was in the public interest that accounting should not aggravate cost-push inflation. Historic cost was seen as providing this aggravation and thus needed changing. Once the economic problem was past, the accounting treatment was not relevant. The public interest concern was heightened by industrial companies at the outset. It was no longer seen as a problem according to industrial companies at the end.

5.2.2. *Inflation accounting and accounting for PFI: a comparative analysis*

The above provides an analysis of the inflation accounting disagreement from which some comparative points with the PFI accounting debate can be made. Unlike the inflation example, where the ASSC and ASC were on the defensive, arguably the Government was the weaker body in relation to accounting for PFI. There was a different starting point: with inflation accounting the ASC made the first attempt to solve the matter, with PFI, HMT started the process. In the inflation case the Government dramatically disagreed with the ASC, which had to change. In the PFI case, ASB disagreed with HMT and the latter had to change at least in terms of espoused practice. This arguably put HMT in a weaker position, but its interpretation was a clever attempt at 'interpreted' compliance. It partially[22] gave HMT what it wanted – a large number of PFI transactions remaining off public sector balance sheets. But even to achieve this HMT had to go down a route it would have preferred not to travel – it proved very expensive from many perspectives to have to design a suitable interpretation of a standard about which it was less than enthusiastic. In fact, to achieve the Government's purposes needed other changes – notably, a shift in perceptions that value for money considerations needed to be decoupled from the balance sheet decision – to neutralise the negative influence of the proposed accounting treatment over the economic effects. With inflation, a real, rather than perceived, economic problem was solved over time leading to the accounting treatment becoming largely irrelevant – hence the indifference towards accounting issues portrayed by Government in 1985/6. But, in both PFI and inflation, the Government pursued what we would argue is its prime objective: to ensure that accounting procedures and practice do not lead to or aggravate actual or perceived economic problems since to do so is not in the public interest.

Inflation clearly had a much more significant economic impact than PFI decisions, which may indicate why the government's approach to the two interventions differ; yet at another level, there does seem to be a different set of relationships at work. In the 1970s the accounting profession was only just finding its feet in terms of self-regulation. Given the enormity of the inflation problem and the youthfulness of the ASSC and the levels of trust (and respect?) in which the embryonic regulatory body was held, whether it could manage what was required was genuinely in doubt. The late 1990s were different, since the ASB (and its predecessors) had an accumulated 30 years of experience of accounting regulation behind them and therefore had more self-confidence. It also had the added legal support which the 1989 Companies Act gave the ASB and its forebears. With inflation accounting, the basic accounting approach was determined by Government. With PFI accounting it was determined by the ASB, despite the Government's initial attempt to provide a clear lead. In both cases, however, Government still ensured that its view of the public interest was fulfilled. With inflation accounting, SSAP16 was an acceptable (to Government) – if not optimal – accounting solution for the periods of high inflation. Once inflation subsided, accounting for inflation was largely irrelevant. No such respite has been possible with PFI. More subtle forms of interpreted compliance have been necessary to satisfy perceived public interest concerns.

Finally, and as a concluding thought, it is interesting to note that in both inflation accounting and accounting for PFI the government ensured that the public interest was served by quite negative techniques. These involved different approaches to neutralising the worst economic effects of the accounting treatment. While inflation was at its height, the Government was of the view that CCA was seen as the only viable solution and, despite the tortuous suggestions of the accounting profession, whatever form CCA took, it was better than none at all. It was certainly better than CPP. Once inflation was past its worst the Government could return to its more non-intrusive stance, since the accounting treatment was largely irrelevant as it had minimal negative economic consequences. In this way there was a neutralising of the accounting treatment. With PFI accounting no such long-term Government insistence on forms of accounting treatment was possible. The long-term agenda on accounting treatment has been set by the ASB. The worst perceived effects of the ASB's accounting treatment has been neutralised, to an extent, by the interpretation that the Government made. Yet to thoroughly neutralise any further negative effects required clear distancing of the balance sheet accounting treatment from the important value for money judgment. Perhaps if these perceived connections had not been there initially the Government would not have had to resort to its interpretation.

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[22] With 57% of all PFI transactions appearing on public sector balance sheets, their 'interpretation' was not an unbridled success, although again the point about the careful interpretation of this statistic in the light of accounting for the PFI of the London Underground is needed.

6. Concluding comment

This paper has been concerned with the complex relationships between government and the ASB, and the tensions that have occurred over the years in these relationships. We have explored, in some detail, one of the latest examples of these points of tension in relation to accounting for PFI, contrasting this with the disagreements surrounding accounting for inflation to add additional dimensions to the nature of these tensions. Two conclusions stand out from the contents.

First, that government has an ongoing expectation that institutions and organisations (such as the accounting profession) should work in the public interest. We have adopted a Habermasian perspective on the role of government, seeing this body as being in existence to steer/guide the functioning of social systems to serve the interests of the public. The 'interests of the public' is given meaning, in an ideal type sense, (continuing our Habermasian framework) in complex ways through referral to the 'societal lifeworld' which contains the accumulated views of the way we would want to see our world, our social relations and ourselves. Following this logic, organisations and professions have a role to perform within this societal order. The government is the custodian, director and monitor to ensure that this role is performed.[23] In this connection, professions, such as accounting, like other professions as well as other organisational units, are set up as societal systems to achieve this end. As separate systems they are likely to secure their overall autonomy of action within society if they are to adequately perform the complex tasks which society expects (Broadbent et al., 1991). Sikka and Willmott (1995), arguing from a different theoretical perspective, see this autonomy as an important part of the legitimation of the capitalist society. Government, however, while in some ways encouraging this autonomy for effectiveness purposes, still has to ensure that the public interest is achieved. This dynamic is a living tension, which, for most of the time, does not cause difficulties. However, at particular points of time, when the quasi-autonomous unit – in the context of this paper the accounting profession – ventures beyond perceived acceptable bounds, then governments have to act to 'steer' behaviour. Exactly how this works out in particular circumstances differs. This is demonstrated through the primary focus of the paper – namely the interactions between different governments and the accounting profession, focused primarily on the ASB (and its forebears). However, the important point to stress is the more general claim that tension between government and the organisations and professions over which it has charge, while latent at any point and on any topic, is always present. The possibility remains that it could erupt at any time depending on the circumstances. This will only occur where, following the focus of the paper – accounting regulation – is perceived to be unacceptably breaching norms of behaviour, which are seen not to be working in the public interest.

Second, as demonstrated by the two cases used, tensions between different UK governments and the accounting profession will be expressed in different ways at different points in time. The former, while respecting the latter's quasi-independence, on the grounds of its custodial public interest role, will be seeking to be in final control. The development of accounting regulatory bodies – the ASSC, the ASC and the ASB – are all arguably outcomes of major public interest concerns. These were reactions by the accounting profession to some major industrial scandals of the 1960s and 1980s. These reactions were ways to demonstrate to the government s at these times that the profession could prevent such occurrences in the future by developing new accounting regulatory systems. Our view is that similar tensions surround the modes of accounting to be adopted for particular accounting issues. Our main example to demonstrate this view has been the disagreements between the Government and the ASB in relation to accounting for PFI. The paper has contrasted this disagreement with the one that surrounded accounting for inflation in the 1970s and 1980s. Although both cases demonstrate this same tension the respective reactions of the accounting regulatory bodies and the government show important differences. Similarly, the nature of government's satisfaction that the public interest has been achieved also differs. Despite the differences, our view is that whatever its nature such satisfaction is essential. In the inflation accounting issue this satisfaction was achieved, not by accounting means, but through the emergence of lower inflation which made the accounting treatment largely irrelevant. In the case of PFI it has required more subtle forms of interpreted compliance to the ASB's accounting requirements. This included trying to shift perceptions by distancing the value for money judgment from the accounting treatment as well as changing the macro fiscal rules to avoid counting against public borrowing. In both cases, as with the creation of the ASSC and ASB, government has allowed the self-regulation of the accounting profession to continue. Had either the neutralising of the economic effects of accounting failed or, more positively, accounting failed to demonstrate that it was working in the public interest then, arguably, government would have continued to be actively engaged in influencing the profession's behaviour. This is in spite of the normal and permitted self-regulation of the accounting profession. When societal systems are working in the public interest, governments are unlikely to interfere with their self-regulation. Our view is that governments will allow these to operate independently as long as they are working in what they perceive as the public interest.

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[23] This, of course, assumes that the government as a steering media is fulfilling its own public interest role. This is not always the case and the Habermasian framework theorises when this can and does occur. For this paper, however, it has not been important to venture into this complex modelling. The public interest we have been discussing throughout this paper is a *perception* of government at a particular time on a particular topic. It has not claimed that this is some absolute, objective and 'correct' view as to what is the public interest. Our concern is with power relationship based on perceptions: if the government of the day *believes* – that something is not in the public interest, even if that belief is 'wrong' – however determined – our argument is that they will act and try to ensure that their perception of the public interest is achieved.

What other tactics might be called into play in the future, either from government or the accounting profession, is difficult to ascertain, but some things are more certain: the possibility of underlying tensions will always exist between the two. These tensions will become apparent when the accounting profession steps beyond perceived boundaries of acceptable behaviour – beyond working in the public interest. Whatever the reaction of the accounting profession to this situation, government will inevitably endeavour to find ways to ensure that its preferred forms of behaviour are realised in the name of the public interest – since that is its assigned societal role.

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How not to mount a professional project: the formation of the ICAEW in 1880

John Richard Edwards, Malcolm Anderson and Roy Chandler*

Abstract—This study addresses 'the inevitable dilemma facing [leaders of] an occupation' seeking to progress the professionalisation process through organisational formation, namely that 'if too many are included as eligible, it may downgrade the whole membership, while if the line is drawn too narrowly, those left out may be of sufficient ability to form a rival body' (Macdonald, 1995: 192). It examines this dilemma in the context of the formation of the Institute of Chartered Accountants in England and Wales (ICAEW) in 1880 through the merger of five accounting societies formed during the previous decade. We show that creation of the ICAEW was engineered by London City-based accountants, primarily those who had directed the affairs of the ICAEW's elite predecessor body, the Institute of Accountants. We will argue that, through organisational fusion, the ICAEW's leaders expected to achieve organisational closure of the public accountancy profession in England and Wales, but this endeavour was flawed because of their failure either to adopt a sufficiently inclusive strategy at the date of formation or to address that deficiency in the years that immediately followed. This created an alienated population of 'country accountants' and left available a substantial reservoir of public accountants from which the first competitor organisation formed – the Society of Accountants – was able successfully to recruit.

1. Introduction

The formation of an organisational body, whether inspired by principally altruistic motives (e.g. Millerson, 1964), primarily political motives (e.g. Willmott, 1986), naked self-interest (e.g. Johnson, 1972) or a combination of these (e.g. Lee, 1995), is a key stage in the professionalisation process. Indeed, numerous writers in the past (e. g. Pixley, 1897/1978:1) and today (e.g. Kirkham and Loft, 1993; Lee, 1995; Matthews et al., 1997) portray professionalisation as beginning with the formation of an organisational collective. Consistent with Carnegie and Edwards (2001:303–4), we attach a rather different significance to the formation of organisational collectives. The professionalisation process is marked by 'signals of movement' towards professional status with, during the pre-organisational period, an occupational group achieving greater economic reward and perceived respectability as the result of an enhanced degree of public recognition of the societal value of the services it offers. The professional body may be seen as a mechanism for exploiting these perceptions and, with government recognition (and perhaps endorsement as a monopoly supplier of specialist services), for enabling enhanced rewards to be secured both socially and economically. That is, the creation of the organisational collective is when a professionalisation process is underpinned by certain members of an occupational group consciously pursuing a professional project.

The establishment of what Millerson (1964) labelled a 'qualifying association' involves the need to address 'the dilemma of exclusiveness versus market control' (Macdonald and Ritzer, 1988:257). The choice is either to confine membership to high status practitioners, thus ensuring the almost certain emergence of competitor institutions, or to include all members of an occupational group and thereby accept the risk, at least in the short term, of a diminished public perception of a group's professional ranking within society (Perkin, 1989). This precise dilemma was acknowledged by Frederick Whinney when explaining the all-inclusive concept underpinning the ICAEW-sponsored Bill designed to achieve state recognition for public accountants in 1893:

> 'It was an axiom that when they sought to make a profession a restricted one – that was to say, a profession which could only be exercised by those who were duly qualified, they must, in order to get the consent of the Legislature, take in all those persons who, at the time the Bill was passed, or within a very short time previously, were practising that calling… If they went in for restrictive legislation confined to the members of the Institute they could not possibly get a bill passed. If they wanted restrictive legislation they must take in all those who had anything like a reasonable title to be considered within the

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Table 1
Temporal pattern of recruitment of ICAEW founders to predecessor societies

Year	*Liverpool Society*	*London Institute*	*Manchester Institute*	*English Society*	*Sheffield Institute*	*Total*	*%*
1870	15	43	0	0	0	58	9.3%
1871	0	67	36	0	0	103	16.5%
1872	1	2	1	97	0	101	16.2%
1873	0	8	2	16	0	26	4.2%
1874	0	18	0	12	0	30	4.8%
1875	1	1	5	21	0	28	4.5%
1876	1	2	6	17	0	26	4.2%
1877	0	7	5	46	26	84	13.4%
1878	0	11	2	12	2	27	4.3%
1879	13	18	31	24	4	90	14.4%
1880	0	11	18	22	1	52	8.3%
Total	**31**	**188**	**106**	**267**	**33**	**625**	**100.0%**
Wade and Guthrie						2	
						627	

Sources: ICAEW, 1881, 1882, 1883; Guildhall Library, MS28404, Report of the Council, Rules etc, 1879: 14.

purview of the Bill....The President of the Board of Trade said 'I cannot give you a monopoly,' and thereupon they had to modify their Bill, and they did modify it so as to make it a pure Registration Bill – one which would protect their title.' (quoted in *The Accountant*, 27 May 1893: 503)

We will see that this lesson had been learned as the result of failure to achieve organisational closure of the public accountancy profession when a unique opportunity to do so had arisen 13 years earlier.

The immediate trigger for the formation of the accounting association that was the dominant professional accounting body in Britain for many years, the ICAEW, is claimed to have been (Pixley, 1897/1978:2) or perceived to have been (Millerson, 1964:51) the need to distinguish the reputable from the disreputable or *soi-disant*[1] ('so-called') accountant who was damaging the public image of the occupational group. Certainly the ICAEW's charter application (1880) argued that differentiation, through incorporation, would result in 'public recognition of the importance of the profession and would tend gradually to raise its character and thus to secure for the community the existence of a class of persons well qualified to be employed in the responsible and difficult duties often devolving on public accountants' (ICAEW, 1881:197).

The case put forward by those petitioning[2] their monarch, Queen Victoria, for the award of a Royal Charter and the creation of the ICAEW in 1880 indicates that, as part of the process of distinguishing the reputable from the disreputable, they publicly espoused a policy of exclusiveness without, perhaps, anticipating its inevitable consequences. The petition contained the following assertion:

> 'That the aggregate number of members of the said societies exceed 500 and in that number are comprised nearly all the *leading* public accountants in England and Wales.' (ICAEW, 1881:196, emphasis added)

If the expectation of the promoters of the ICAEW was that they would also achieve national control of the qualified element of the accounting occupational group, i.e. organisational closure, they were to be quickly disappointed with the first rival association, the Society of Accountants (SA), formed just five years later.

This study therefore seeks to help redress the lack of research into what Macdonald terms 'the inevitable dilemma facing an occupation' (1995:192). He contends that 'if too many are included as eligible, it may downgrade the whole membership, while if the line is drawn too narrowly, those left out may be of sufficient ability to form a rival body'. We will argue that the ICAEW leaders' endeavour to achieve organisational closure was flawed because of their failure to adopt a sufficiently inclusive strategy, at the date of formation, leaving available a reservoir of public accountants, particularly in certain geographical areas, from which the SA was able to recruit.

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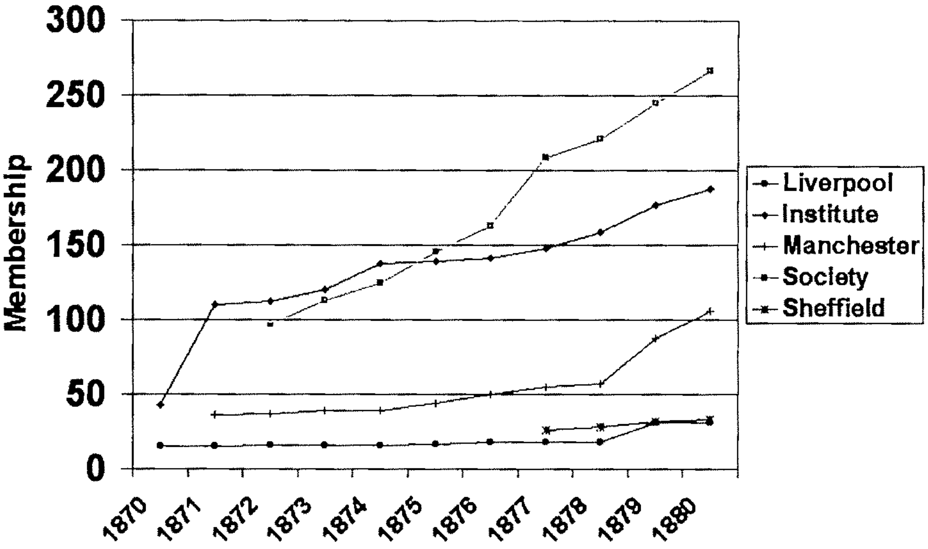
[1] This term is used in *The Accountant* (November 1874:2) when calling for the creation of a united body of accountants.

[2] The petitioners consisted of the presidents of the five merging societies together with the combative Edwin Guthrie and Charles Henry Wade (see below).

Figure 1
Temporal pattern of recruitment of ICAEW founders to predecessor societies



2. Sources

The main documentary sources consulted for the purpose of this research are: the records of the Institute of Accountants, the ICAEW and the SA deposited at the Guildhall Library, London; the lists of members published by the ICAEW and the SA in the 1880s; city directories for the period 1879–85; Harper's *Accountants' Directory*, 1877; and reports prepared for Parliament on the results of the 1881 census. There are often problems with the completeness and accuracy of the material used for the purpose of archival research and, where possible, data triangulation has been employed to help reduce the level of error. For example, for the purpose of constructing Table 3, the material contained in the 1881 *List of Members* was compared with the ICAEW's internal records to identify errors and omissions from the former. It was discovered that ten of the founder members, as shown by the membership lists, were omitted from the *List of Members*[3] and the previous affiliation of each of these was obtained either from Harper (1877) or the membership records of the ICAEW.

The remainder of the paper is structured as follows. In the next section, we reveal the pattern of recruitment to the five societies formed in England in the 1870s through to the date of organisational fusion in 1880. Section 4 examines the process of constructing the ICAEW, while the following section considers the status accorded to former members of the foundational societies in the merged institution. The geographical coverage of the aspiring national institute is described and explained in Section 6. In Section 7, we consider the extent to which the membership of the new body drew from the available population of public accountants, given the claim from those leading the merger campaign that they were creating 'a body representative of the whole profession' (Guildhall Library, MS28405, vol. 1: fo. 414) and their boast of capturing 'nearly all the leading public accountants in England and Wales'. We also attempt to assess whether the new body was able to meet nation-wide requirements for the services of the newly constructed financial expert. Section 8 explains why the ICAEW leaders' desire for organisational closure was unfulfilled and Section 9 presents our concluding remarks.

3. Temporal pattern of recruitment to accounting societies

The growing number of practising public accountants in Victorian Britain was accompanied by the formation of the first modern organisational collectives in Scotland, in 1853, in the cities of Edinburgh and Glasgow. These actions were emulated by accountants working in England, starting with the establishment of the Incorporated Society of Liverpool Accountants (the Liverpool Society) in 1870. The following further city-oriented collectives were created during the 1870s: the Institute of Accountants in London[4] (the London

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[3] Only one of these (James Bishop) could be explained by resignation prior to the date of publication.

[4] Renamed the Institute of Accountants, in 1872, and from that date suitably qualified accountants outside the capital could join, although we will see that few did.

Table 2
Membership of the London Institute 1871–80

	1871	*1872*	*1873*	*1874*	*1875*	*1876*	*1877*	*1878*	*1879*	*1880*
Actual membership	134	137	148	160	160	154	156	164	178	188
From Table 1	110	112	120	138	139	141	148	159	177	188

Sources: ICAEW, 1881; Walker, 2004b: 129.

Institute), 29 November 1870; the Manchester Institute of Accountants, 16 February 1871; and the Sheffield Institute of Accountants, 14 March, 1877.[5] The Society of Accountants in England (the English Society) which, as its name implies, targeted a national membership, was formed in 1872. The ICAEW's first official history[6] concludes that the entrance fees set by the London Institute 'for Associates operated as an effective bar to the admission of many struggling but reputable and competent practitioners' (Howitt, 1966:8; see also *The Accountant*, 4 May 1878:3),[7] and it was quite possibly members of this alienated grouping that came together to form the English Society two years later.

Table 1 sets out and Figure 1 displays the temporal pattern of recruitment of ICAEW founder members to the societies formed during the 1870s and reveals, unsurprisingly, a significant influx of accountants during the first three years of the 1870s when four of the societies were formed. In total, 42% of the members of the merging societies were recruited during these years. It must be acknowledged that the level of recruitment to each of the five associations, as set out in Table 1 and Figure 1, is understated with, overall, an unknown number of joiners having left (due to death, resignation or exclusion) prior to merger. Figures from the annual reports and internal records of the London Institute (reported in Walker, 2004b:129) enable us to make an assessment of the understatement for that organisational collective. The comparison, reported in Table 2, shows that the figures derived from the *List of Members* understate the true position by roughly 10%.[8]

Between 1873–6 (see Table 1), the highest number of new members in one year was 30, giving proportions that ranged from 4.2% to 4.8% of the founder cohort. The reasons for stagnation are unclear, but may well be attributable to the tendency of all bodies, other than the English Society, to recruit, in the main, local accountants (see Section 5 of this paper). Even when the London Institute took the decision to open its doors to provincial members in 1872 continuing restrictive arrangements had their effect. The report of the Council to the second annual general meeting on 23 April 1873 states:

> 'Up to the present time, the number of applications which have come in under these rules is inconsiderable. The practical difficulty which attends the requirement under rule 6 of a recommendation signed by 3 fellows,[9] is found to present a more serious obstacle to the admission of provincial members than was anticipated when the new rules were framed.' (Guildhall Library, MS28404: fo. 31)

There was something of an upsurge in overall membership in 1877, partly brought about by the formation of the Sheffield Institute[10] but also because of the significant expansion of the English Society's membership, but recruitment fell back to just 27 new entrants in 1878. This was soon to change, with John Paterson – a member of the London Institute – displaying admirable prescience when pointing out, early in 1878, that

> 'There is always a certain amount of prestige and influence attaching to a legally incorporated

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[5] Reasons for the formation of the four city-oriented accounting societies, at various points in time during the 1870s, are given in Walker, (2004a).

[6] Other histories prepared for some of the institutions considered in this paper are: Hargreaves, 1970 (Liverpool Society); Hoe, 1977 (Sheffield Institute); Hopkins, 1980 (ICAEW); and Margerison, 1980 (ICAEW).

[7] The initial entrance fee for fellows was 30 guineas (£31.50), but it was decided, in July 1873, to increase the levy to 50 guineas, effective from 1 July, 1874 (Guildhall Library, MS28404: fo. 38). The entrance fee reverted to 30 guineas in 1878 (*The Accountant*, 27 April 1878: 6). The annual subscription was five guineas. The corresponding figures for associates were 10 and 2 guineas. Given that the typical annual salary for a newly qualified accountant in the 1880s seems to have been between £70 and £100 (*The Author*, 1886: 52; Kettle, 1957: 74), Howitt's explanation seems plausible.

[8] A similar comparison for the Manchester Institute, for 1876, gives 56 members in its annual report (*The Accountant*, 8 July, 1876: 13) compared with the 50 recorded members at the end of that year as revealed in Table 1. The English Society, however, appears to have had a higher level of turnover; its annual reports for 1872 and 1875, for example, give figures of 101 and 201 (*The Accountant*, October 1874: 13; 15 May, 1875: 6) compared with cumulative totals of 97 and 146 derived from Table 1.

[9] This condition had been considered of 'fundamental importance as the only real security they [the Council] can have for the professional competency and status of candidates' (Guildhall Library, MS28404: fo. 31).

[10] This exaggerates the rise in the number of qualified accountants, given that 18 of the 27 ICAEW's founders with dual qualifications on merger (see below), all already members of the English Society, joined the Sheffield Society in that year.

> society over a voluntary association such as ours is at present, and I am certain that if our Institute would be incorporated … during the year 1878, we would see an immense increase to the number of our members before 1880.' (Guildhall Library, MS28405, vol. 1: fo. 356)

The contents of Table 1 reveal a significant expansion of new membership in the 16 months or so prior to the date when the Royal Charter was granted: 90 new entrants in 1879 and 52 more in the first four and a half months of 1880. The upward trend is particularly noticeable in the provinces with Liverpool and Manchester admitting, respectively, 41.9% and 46.2% of their membership on merger, during the 16 months prior to formation of the ICAEW. The statistics contained in Table 1 therefore prove that, as the move towards a government-recognised body of 'official', ultimately chartered, accountants gained pace from January 1879 onwards, significant numbers of public accountants decided to join existing associations so as to ensure that they were not excluded from what was perceived to be a more prestigious, incorporated national collective. This conclusion is reinforced when we observe recruitment trends in the nine months following the award of a Royal Charter when 436 new members were admitted, representing a rise in the membership in England and Wales of 76.8% – i.e. over 100% when expressed as an annual rate (derived from ICAEW, 1881).

4. Creating a national institution

Walker (2004a:127) draws on 'theories of jurisdictional boundaries, occupational conflict, the creation of labour market shelters and social closure' to explain the formation of accounting societies in England in the 1870s. The intended purposes of organisational formation were found to be 'the protection of established accountants from interlopers' and, in Liverpool, to enable a division of insolvency work to be agreed upon with lawyers (Walker, 2004a:146). Given that the four city-oriented organisational collectives maintained primarily a local focus, and that the English Society was generally considered to be a lower status body (see Section 5), the possibility of any of them being able to pursue, successfully, a professional project remained remote. According to Walker (2004b:29; see also Freidson, 1994) a 'National-based organisation offers greater opportunities for securing occupational control and protection, and for pursuing market advantage through credentialism and state registration'. Beyond this, Abbott believes that the 'national association' should embrace 'the *whole* societal task' in order to pursue effectively public or legal claims (Abbott, 1988:83, emphasis added).

The case for creating a national organisation was recognised by the prominent Victorian accountant and MP for Macclesfield, David Chadwick, in the year (1870) that the Liverpool Society and the London Institute were established. He advocated the formation of a 'central institute, with affiliated branches throughout the kingdom' to counter '[t]he feuds and competitions which have so long existed between the metropolitan and provincial accountants [and] have grown into a public and intolerable nuisance' (quoted in Walker, 2004b:30). Four years later, the columns of *The Accountant* (October 1874:5–6) expand upon the perceived benefit of a unified body:

> 'Independent local associations are of very little use in themselves, but one general association, with local branches, constructed on a right basis, properly conducted, and well supported, would be very effective in raising the standing and promoting the interests of accountants, and thereby benefitting the public at large.'

More specifically, it was thought that a unified body might prove a more effective mechanism, firstly for protecting and enhancing the public accountants' public profile by countering external attacks from, for example, lawyers, and, secondly, for functioning as a more cohesive pressure group, for example in relation to proposed legislation. Much of the public criticism of accountants centred around the *soi-disant* accountants who, it was alleged, emerged in large numbers to exploit opportunities for work under the Bankruptcy Act 1869 (Walker, 2004b:251, 259). A unified body, it was believed, could better help the public to distinguish the legitimate professional accountants from the undesirable 'others'.

An initial problem was how best to achieve unification, with the discussion revolving around either registration by incorporation or through the award of a Royal Charter. A key attraction of registration, if it could be achieved, was that it would result in occupational closure, i.e. only those accountants appearing on the register would be permitted to offer accounting services to the public. A Royal Charter, on the other hand, was a highly valued signal of state recognition. David Chadwick urged the leading accountants to seek 'incorporation and the advantage of conferring on competent accountants the same relation to the state achieved by lawyers' (quoted in Walker, 2004b:173). This route was selected by the London Institute precisely because, according to its secretary, 'Such a charter would not, of itself, prevent persons not members of the Institute from practising as public accountants' (Guildhall Library, MS28408, vol. 2: fo. 202).

Not everyone was convinced that such an outcome was feasible, and events over the next 100 years or so have proved conclusively an inability to achieve registration based on the notion of the 'public accountant'. Frederick Whinney pointed to the fact that it was 'impossible', for example, 'to hinder a man from keeping a tradesman's books' (*The Accountant*, 27 April 1878:9). Whinney did believe, however, that there was some possibility that a unified body might achieve recognition for performing *certain* important services:

> '...when you come to the term trustee, and I would include in that liquidator, I think that is a different matter. ... I should like myself for us to endeavour to get an Act of Parliament to prevent any one practising as a professional trustee or liquidator unless qualified.' (*The Accountant*, 27 April 1878:9)

At a Council meeting held on 3 May 1878, it was decided to seek incorporation, by private Act of Parliament, under the title of 'The Incorporated Institute of Official Accountants' (Howitt, 1966:17). Towards the end of 1878, the London Institute communicated to the other societies its intention to present an Incorporation Bill to Parliament allegedly structured 'in the interests of the whole profession' (Guildhall Library, MS28405, vol. 1: fo. 414). It was also believed that there was 'a real prospect' of the measure being considered in tandem with the government's planned Bankruptcy Bill to achieve the kind of outcome envisaged by Whinney through giving members of the incorporated society preferment – perhaps even a monopoly – in undertaking insolvency work (Walker, 2004b:186, 243, 251).

The move towards unification was gaining momentum, but achieving agreement on the form that any union should take proved intensely problematic because '[t]here were different notions in London and the provinces about what constituted public practice' (Walker, 2004b:205). The Manchester Institute was keen that estate and insurance agency should be considered legitimate work, arguing that 'these branches of business' were 'consistent with the usage and practice of a solicitor' (Guildhall Library, MS28405, vol. 2: fo. 25). With the same broad purpose in mind, a letter from the Secretary of the Liverpool Society to the London Institute expressed concern that the definition of a bona fide public accountant would exclude 'those who are admittedly also Sharebrokers, Auctioneers, Estate Brokers, Debt Collectors and the like', pointing out that 'in our professional capacity the management of estates and the collection of debts must be part of our business and we cannot be disqualified thereby' (Guildhall Library, MS28405, vol. 2: fo. 19). The issue was certainly no less important in the other provincial city where an accounting society had been created because, according to Howitt (1966:18), 'many of the most respected members of the Sheffield Institute were brokers as well as accountants'.

The determination of the London Institute's leaders to confine the new body to public accountants per se is reflected in the following resolution of its Council: 'That the Council, after careful deliberation, considers that the true interest of the profession requires that eligibility for membership should be limited to persons whose only business is that of public accountant.' (quoted in Howitt, 1966:19) Walker, on the basis of his examination of the London Institute's records, is struck by its leaders' classification of the profession into public accountants in the metropolis – mainly city accountants – 'and a residual, identified collectively as "country accountants"' (Walker, 2004b:254). This latter group, as the preceding paragraph indicates, were more likely to offer to the public services outside the natural jurisdiction of a specialist accountant.[11] The leaders of the London Institute therefore sought to ensure, as far as possible, the purity of the planned new body by drafting a bill which ensured its dominance of the new organisation. The merged association was to adopt the London Institute's rules, be governed by its Council members and comprise its existing membership together with 'all other persons who shall hereafter become Members' (reproduced in Walker, 2004b:296).

The other societies were naturally unimpressed, with the position further complicated by the formation, in December 1878, of the Accountants' Incorporation Association under the leadership of Edwin Guthrie and Charles Henry Wade of the leading Manchester firm Thomas, Wade, Guthrie & Co. Kitchen and Parker (1980:9) tell us that the purpose of the Association was to protect 'the interests of those [accountants] not members of any existing accounting body'. The infighting which took place between what were now six accounting associations is well documented (Howitt, 1966, ch. 1; Walker, 2004b, chs. 10–11). The serious and sometimes bitter negotiations resulted in the London Institute eventually accepting the fact that, for a merger to occur, it was necessary to adopt a more inclusive strategy despite the fact that such a policy risked admitting 'marginal practitioners who lower the standing of higher-status members' (Macdonald and Ritzer, 1988:257–8). The outcome was that all existing members of the five merging bodies were eligible under the Incorporation Bill to become founder members of the ICAEW. This arrangement did not extend to the members of the Accountants' Incorporation

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[11] As Walker (2004b:254) puts it: 'The large, successful London firms of public accountants looked askance at those within their locality and beyond who perceived that "trade" activities such as broking, agency and collection were within the orbit of professional practice.'

Table 3
Previous affiliations of the founder members of the ICAEW

Affiliation	*FCA*		*ACA*		*Total*	
	no.	*%*	*no.*	*%*	*no.*	*%*
Liverpool Society	23	10.1	8	2.2	31	5.2
London Institute	104	45.6	82	22.0	186	31.0
Manchester Institute	53	23.2	49	13.2	102	17.0
English Society	39	17.1	226	60.8	265	44.2
Sheffield Institute	7	3.1	7	1.9	14	2.3
Guthrie and Wade	2	0.9	0	0.0	2	0.3
Total	**228**	**100.0**	**372**	**100.0**	**600**	**100.0**

Sources: Guildhall Library, MS28465; Harper (1877); ICAEW, 1881; Boys, 2004.

Association. Nevertheless, what Walker (2004b, ch. 11) describes as the 'imaginative' tactical manoeuvres employed by its leaders, Guthrie and Wade, saw these two individuals emerge not only as founder members of the ICAEW but also as two of its founder councillors.[12]

In the event, the Incorporation Bill was blocked by Lord Redesdale who, in his role of Chairman of Committees in the House of Lords, had effective supervision over all Private Members' Bills. The offer of a charter in its place was gratefully accepted (Walker, 2004b: ch. 12).

5. Prior affiliations of ICAEW founder members and leaders

We have seen that Table 1 gives, for each of the five merging associations, the number of members joining the ICAEW on 11 May 1880. To these are added Guthrie and Wade to give a grand total of 627. Table 3 supplies information concerning the previous affiliations of the 600[13] men[14] who were actually admitted as founder members of the ICAEW on 11 May 1880 and reveals whether they were categorised as fellows or associates at that date. The difference of 27 (detailed in Boys, 2004:39) between the totals of Tables 1 and 3 is accounted for by dual memberships at the date of organisational fusion, of which 23 involved the English Society.

For the purpose of constructing Table 3, accountants with dual pre-merger qualifications were allocated to the society that they first joined though, if they had progressed from associate to fellowship status by the time of organisational fusion, they have been recorded under the senior heading. The logic behind the societal classification used is that such individuals would have been eligible to become founders of the ICAEW even if they had not collected the second signal of fitness to practice.

Table 3 shows that the English Society was, numerically, comfortably the largest of the merging bodies accounting for 44.2% of the initial membership of the ICAEW. Indeed, the London-based bodies together accounted for three-quarters (75.2%) of the new membership. Manchester remained a significant contributor at 17% with Liverpool and Sheffield lagging well behind at 5.2% and 2.3%[15] respectively.

When we turn to an analysis of the founders between those who became fellows and those who became associates, a rather different picture emerges. One hundred and four of the original fellows came from the London Institute and this accounted for 45.6% of the total in contrast with just 17.1% in the case of the English Society. The second most prominent grouping was Manchester, with 23.2%. It certainly seems that the English Society was very much the junior partner in this merger, with its lower perceived status probably dating from its formation. A letter from Miller, Monkhouse, Goddard & Co.[16] (4 January, 1872) alerted the secretary of the London Institute to the fact that the English Society had been formed, and continued:

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[12] Guthrie and Wade's main supporters seem to have been five Manchester public accountants among whom Edwin Whitehead Marshall was a founder associate of the ICAEW (by virtue of his membership of the English Society), Lonsdale Broderick and James Marchanton were admitted as fellows on 22 September 1880 and 5 January, 1881 respectively, while Joseph Affleck and H. Musgrave Briddon became associates on 6 April 1881 (ICAEW, 1881; Guildhall Library, MS28411, vol. 1: fo. 85).

[13] The prior literature contains a variety of incorrect totals for founder members (including the 587 cited by Howitt, 1966:24) and a number of other factual inaccuracies relating to the formation of the ICAEW. These are examined and explained in Boys, 2004.

[14] The first female (Mary Harris Smith) was admitted to the ICAEW in 1920 (*The Accountant*, 8 May, 1920: 547).

[15] The removal of dual membership has affected the youngest accounting body, the Sheffield Institute, disproportionately, given that 19 of its members at merger, out of 27 accountants with dual qualifications, first joined other bodies. If we include the dual memberships (Table 1), proportions become: Liverpool Society, 4.9%, London Institute, 30.0%, Manchester Institute, 17.0%, English Society, 42.6%, Sheffield Institute, 5.3%, Guthrie and Wade, 0.3%.

[16] George Benson Monkhouse and Frederick Robertson Goddard were admitted to the London Institute, as fellows, on 25 November, 1873.

> 'Our own firm and the two other principal firms of Accountants in Newcastle ... unanimously came to the conclusion that ... it would be quite out of the question for either of our three firms being connected with the proposed Society. In the first place, it has not got the right people at the head, and second, they seem disposed to admit any man who chooses to call himself an Accountant without any other test or qualification. Certainly one of the Newcastle men whose name is on the Provisional Committee should not be admitted into any Association of Public Accountants, the other[s] we don't know much about, and generally they seem quite second-rate men, at least the provincial names, and some of the town names seem even third-rate.' (Guildhall Library, MS28404: fo. 70)

The influential position achieved by the London Institute, as a result of the merger arrangements, is also reflected in the composition of the first Council of the ICAEW. The 45 Council members accounted for 7.5% of the membership of the new body. The London Institute obtained 20 seats[17] on the Council, comprising 10.6% of its prior membership. The English Society, although having about 50% more members than the London Institute negotiated just 14 seats on the new Council, or 5.2% of its total membership. The societies based in the other three cities were allowed just three seats each representing, as a proportion of total membership, 9.7% for Liverpool, 9.1% for Sheffield and 2.9% for Manchester. As noted above, the Manchester accountants Guthrie and Wade also became founder Council members raising that city's representation to five.

The initial Council was City of London-dominated, with no fewer than 27 of its membership working in 'the Square Mile'. Eighteen of these were representatives of the London Institute; eight were from the English Society and one from the Manchester Institute. Given their preponderance on the Council, unsurprisingly City of London members also established a firm grip on the main policy-making committee (Committee to draw up the Bye Laws and for General Purposes, 10 members out of 17), the Committee to Assess Applications (five members out of eight) and the Committee to Investigate Alleged Miscreants (all seven members) (Guildhall Library, MS28411, vol. 1: fos. 2, 62, 121).

6. Geographical distribution of ICAEW founder members and leaders

Four of the societies that merged to form the ICAEW in 1880 – the city-oriented societies – were principally concerned to advance the interests of public accountants in their localities. The exception, the English Society, aimed from the outset to attract a national membership. Established two years after the Liverpool Society, 14 months later than the London Institute and nine months after the Manchester Institute, this was an early example of a newly formed organisation adopting a broader recruitment strategy in order to compete with collectives already established.[18]

The differing recruitment strategies of the founding bodies are reflected in the content of Table 4 which gives the geographical location of the founder members of the ICAEW. The table supplies combined figures for the four city-oriented societies and separate figures for the English Society. It will be noticed that Table 4 is compiled on the basis of 566 rather than the 600 founder members. The explanation is two-fold. First, given the focus on members of the merging societies, Guthrie and Wade are excluded. Second, the new body admitted 32 associates located outside England and Wales. Twenty-five of these were based in Scotland (20 in Glasgow, two in Edinburgh and one each in Ayr, Aberdeen and Fraserburgh),[19] two in Ireland (Dublin), four in India (Calcutta) and one in Australia (Melbourne). All these individuals had previously been members of the English Society, reflecting its 1875 decision to adopt a broadly-based geographical recruitment strategy to boost its membership and influence.

Focusing first on the geographical distribution of the city-oriented societies portrayed in Table 4, 95.5% of the founding fellows and associates worked in practices which were located within the relevant municipality or, in the case of the provincial cities, usually close by in the counties where they were located. The Liverpool Society's entire membership was located within that city, and the position was little different for the other three city-oriented societies including the London Institute which, as noted above, dropped the last two words of its initial title (Institute of Accountants in London) in 1872, reflecting the decision to broaden its recruitment strategy. This action had little ef-

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[17] In addition, David Chadwick, who was one of the Manchester Institute's three representatives (Manchester Institute of Accountants, Minute Book, 30 June 1879: fo. 296), was, by 1880, principally London based (ICAEW, 1881: 4, 14).

[18] Three years later, the English Society took the further decision to look to the Empire for new recruits (*The Accountant*, 15 May, 1875: 7). This initiative pre-dates, by 10 years, the so-called '"British Empire" policy' (Garrett, 1961: 14) formulated by the Society of Accountants.

[19] The newly created Institute of Chartered Accountants in England and Wales included nearly twice as many (25) members based in Scotland as in the Principality of Wales (13).

Table 4
Geographical distribution of ICAEW founder members [1]

	Fellows				Associates				Fellows + Associates				Totals	
	City-oriented Societies no.	*%*	*English Society no.*	*%*	*City-oriented Societies no.*	*%*	*English Society no.*	*%*	*City-oriented Societies no.*	*%*	*English Society no.*	*%*	*no.*	*%*
London	94	50.3	10	25.6	69	47.3	38	19.6	163	48.9	48	20.6	211	37.3
Liverpool	23	12.3	1	2.6	9	6.2	7	3.6	32	9.6	8	3.4	40	7.1
Manchester	44	23.5	1	2.6	33	22.6	12	6.2	77	23.1	13	5.6	90	15.9
Sheffield	6	3.2	16	41.0	7	4.8	13	6.7	13	3.9	29	12.4	42	7.4
Four cities	167	89.3	28	71.8	118	80.8	70	36.1	285	85.6	98	42.0	383	67.7
Rest of Lancs & Yorks	12	6.4	4	10.3	21	14.4	29	14.9	33	9.9	33	14.2	66	11.7
Sub-total	179	95.7	32	82.1	139	95.2	99	51.0	318	95.5	131	56.2	449	79.3
Rest of Eng. & Wales	8	4.3	7	17.9	7	4.8	95	49.0	15	4.5	102	43.8	117	20.7
	187	100.0	39	100.0	146	100.0	194	100.0	333	100.0	233	100.0	566	100.0

[1] Excluding Guthrie and Wade and 32 former members of the English Society working outside England and Wales
Sources: ICAEW, 1881; Boys, 2004.

Table 5
Geographical distribution of initial Councils of ICAEW and SA

	ICAEW		*SA*	
	No.	*%*	*No.*	*%*
London	27	60.0	13	26.0
Liverpool	3	6.7	5	10.0
Manchester	5	11.1	4	8.0
Sheffield	5	11.1	2	4.0
Four cities	40	88.9	24	48.0
Rest of Lancs & Yorks	1	2.2	10	20.0
Sub-total	42	91.1	34	68.0
Rest of Eng. & Wales	4	8.9	16	32.0
	45	100.0	50	100.0

Sources: ICAEW, 1881; SA, 1885.

fect on geographical coverage (Howitt, 1966:12), with 160 of its 186 members, i.e. 86%, based in the capital city (derived from ICAEW, 1881). It is possible that the efforts made by some officials to expand the London Institute's membership were thwarted by its president, William Quilter,[20] and the 'inflexible attitude' that was characteristic of a number of its early leaders (Howitt, 1966:14). Overall, therefore, we can conclude that the city-oriented societies catered mainly for local practitioners.

In line with its recruitment strategy, the English Society developed a significantly more geographically-dispersed membership. Although it was based in London, only 20.6% of its membership came from that city. A further 35.6% (56.2% – 20.6%) were located in Lancashire and Yorkshire, with the remaining 43.8% of its members ('Rest of Eng. & Wales') spread over a further 28 counties (compared with just four counties in the case of the other four societies taken together).

Turning to the 'Totals' columns, the overall domination of London is readily apparent, accounting for 37.3% of the accountants admitted to the ICAEW on merger. The two northern counties in which collectives were established (Lancashire and Yorkshire) contributed a further 42% (79.3% – 37.3%) of the constituency while the 'Rest of Eng. & Wales' accounted for just 20.7% of the total membership. The representation of the latter sub-set is even worse when focusing on the senior membership category, with it supplying just 15 (8+7) of the 226 founders accorded fellowship status. The Midlands, which had by this time become the industrial heartland of England, had only six fellows, Wales just one and most counties in England none at all.

The geographical bias extended to the composition of the ICAEW's first Council, with an overwhelming 88.9% (Table 5) of its membership located in the four home cities of the five merging societies. Table 5 further reveals that 27 (60%) of the first Council members were principally based in London (two of them also had offices in Bristol, one in Manchester and one in Middlesbrough), five in each of Sheffield (one also in London) and Manchester and three in Liverpool. There were just five Council members located elsewhere in England, and none whatsoever in Wales. Moreover, both the founder president (William Turquand) and vice-president (Robert Palmer Harding) were partners in firms located in the capital city.[21]

7. Chartered accountants, public accountants and client needs

In this section, we consider the extent to which founder members of the ICAEW were representative of the occupational group of public accountants of which they comprised a sub-set. We also attempt to assess whether accountants appear to have been geographically dispersed in a manner likely to ensure that potential clients had convenient access to the services of the newly constructed financial expert – the chartered accountant. We acknowledge the fact that population levels are an imperfect surrogate for user needs but, given that the public accountant supplied services to individ-

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[20] Quilter, who had been the London Institute's president since formation, resigned in 1877 because, it is thought, he 'distrusted' the more progressive element led by William Turquand and Frederick Whinney and, specifically, the decision taken to reduce entrance fees for fellows and associates (Howitt, 1966:14). Quilter's resignation appears to have facilitated the move towards merger of the five societies.

[21] Indeed, ICAEW presidents were entirely London-based throughout the remainder of the nineteenth century, with one partial exception, George Walter Knox (1896–7) who practised also in Sheffield. Further, all the presidents, save Knox, had been members of the London Institute on merger.

Table 6
Chartered and public accountants in England and Wales c.1880

	Chartered Accountants [1]	*Public Accountants [2]*	*Population [3]*	*Chartered per 100,000 (Ranking) [4]*	*Public per 100,000 (Ranking) [5]*	*Chartered/Public x100 (Ranking) [6]*
London	211	760	3,816,483	5.5 (1)	19.9 (2)	28% (1)
Lancashire	172	703	3,485,819	4.9 (2)	20.2 (1)	24% (2)
Yorkshire	69	413	2,894,759	2.4 (3)	14.3 (3)	17% (3)
London/Lancs/Yorks	452	1,876	10,197,061	4.4	18.4	24%
South-Eastern	10	157	2,487,076	0.4 (10=)	6.3 (9=)	6% (10)
South-Midlands	6	80	1,512,031	0.4 (10=)	5.3 (11)	8% (8=)
Eastern	9	85	1,343,524	0.7 (8)	6.3 (9=)	11% (4)
South-Western	9	216	1,859,013	0.5 (9)	11.6 (5)	4% (11)
West-Midlands	37	455	3,736,097	1.0 (4=)	12.2 (4)	8% (8=)
North-Midlands	17	178	1,637,865	1.0 (4=)	10.9 (6)	10% (5=)
Northern	15	151	1,624,213	0.9 (6)	9.3 (7=)	10% (5=)
Wales	13	146	1,577,559	0.8 (7)	9.3 (7=)	9% (7)
Rest of Eng. & Wales	116	1,468	15,777,378	0.7	9.3	8%
	568	3,344	25,974,439	2.2	12.9	17%

Sources: Appendix; ICAEW, 1881; Census, 1881, vol. IV.

uals, businesses and companies, and that heavily industrialised areas saw large concentrations of employees and their families, demographics probably represent the best available nation-wide measure of demand.

Table 6,[22] column 1 provides a geographical analysis of the figures for founder members of the ICAEW located in England and Wales (derived from ICAEW, 1881). Column 2 reproduces comparable figures for public accountants extracted from the city directories listed in the Appendix to this paper.[23] Column 3 gives population figures taken from the 1881 census summary tables (*Census 1881, Vol. IV*, Table 7). Columns 4–6 offer some calculations to help interpret the content of columns 1–3.

Column 4 confirms the relative prominence of chartered accountants in London, Lancashire and Yorkshire – the places of initial organisational formation – even when related to size of population. The South-Eastern, South-Midlands, Eastern and South-Western are the worse served, though individuals and businesses located in a number of the counties within those regions may have found it reasonably convenient to enlist the services of a London-based accountant. When we take the figures for public accountants per 100,000 of the population (col. 5), we find significant similarities. The regions where accountants first established accounting bodies are also those where there were proportionately (col. 5), though not quite absolutely (col. 2),[24] the greatest number of public accountants. The region ranked fourth is also the same, the West Midlands. The main alteration in rankings is the promotion of the South-Western region from ninth to fifth; more significantly, the movement reflects the contrast between a *very* low proportion of chartered accountants to a figure for public accountants which is not far behind the fourth in the listing. There are no other changes of significance in the rankings.

Perhaps the most interesting insights are provided by column 6 which expresses chartered accountants as a percentage of public accountants. We see that London is again ranked ahead of Wales and the other regions of England with 28% of the public accountants in the capital possessing chartered status. Lancashire has one chartered accountant amongst every four public accountants, Yorkshire one in six and six other regions about one in ten. Trailing tenth is the South-Eastern region with one in seventeen, leaving the South-Western region in last place with one chartered accountant among each 24 public accountants. This analysis reveals that the newly created occupational sub-group of chartered accountants in England and Wales was unrepresentative of the entire occupational group and, on the face of it, poorly placed to meet business and society's need for the services of the elite new professional.

An examination of the correlation coefficients between the three series of numbers covered by Table 6 produces some interesting insights. When the calculations are based on all the counties in England and Wales, we find a strong correlation (0.972) between the distribution of public accountants and the population, and a lower but still robust measure of 0.923 for chartered accountants related to population. When we exclude the three areas where accountants were first organised (London, Lancashire and Yorkshire), which dominate the above results, we find a significant correlation (0.845) between public accountants and population, whereas that between chartered accountants and population is much lower, at 0.593, revealing the uneven dispersal of qualified accountants throughout the remainder of England and Wales.

8. Unfulfilled aspirations for occupational closure

There is little doubt that those who engineered the formation of the ICAEW in 1880 expected to achieve organisational closure of the accountancy profession. Indeed, the concessions to the other bodies seem to have been made by the leaders of the London Institute in order to achieve that outcome. The official history of the Society of Incorporated Accountants, as the SA[25] formed in 1885 was eventually known, distinguishes between the expectation and reality of arrangements made in 1880:

> 'Thus the Institute's policy had the characteristics of a closed profession, but that policy was

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[22] Separate figures are provided for London, where two societies were formed, and for Lancashire and Yorkshire where the other three foundational societies were established. The remainder of the table is constructed on a regional basis, allocating the counties existing at the time of the 1881 population census (*Census 1881, Volume II*, Table 2) as follows: South-Eastern (Berkshire, Hampshire, Kent, Surrey, Sussex); South-Midlands (Bedfordshire, Buckinghamshire, Cambridgeshire, Herefordshire, Huntingdonshire, Middlesex, Northamptonshire, Oxfordshire); Eastern (Essex, Norfolk, Suffolk); South-Western (Cornwall, Devon, Dorset, Somerset, Wiltshire); West-Midlands (Cheshire, Gloucestershire, Hertfordshire, Shropshire, Staffordshire, Warwickshire, Worcestershire); North-Midlands (Derbyshire, Leicestershire & Rutland, Lincolnshire, Nottinghamshire); Northern (Cumberland, Durham, Northumberland, Westmoreland).

[23] Directories are not available for all parts of England and Wales for every year, and we have therefore used the nearest year to 1880–81 within the range 1879–85. Given that the figures in column 2 comprise the number of entries in the directories, the number of public accountants is understated to the extent that firms had more than one partner.

[24] West-Midlands had more public accountants than Yorkshire.

[25] Its name was changed to the Society of Accountants and Auditors later in 1885, to the Society of Incorporated Accountants and Auditors in 1908 and to the Society of Incorporated Accountants in 1954.

unsupported by legislative enactment restricting public practice in accountancy to its members or regulating the conditions of admission.' (Garrett, 1961:4)

Walker points out that the creation of the ICAEW 'was soon discovered to offer far less than the solution envisaged in 1880' (Walker, 2004b:263). He continues: 'Indeed, this was inevitable given that the formation of the ICAEW was an exercise in intra-occupational demarcation rather than an attempt to organise all "accountants" in Great Britain and Ireland'. Further,

> 'The closure achieved by professional accountants and their supporters during the 1870s was based on differentiation via credentialism as opposed to state licensing, and did not therefore create a *secure monopoly.*' (Walker, 2004b:265, emphasis added)

Theoretically, the available possibilities in terms of closure were at the level of the occupation of public accountants or at the level of its organisational society. The former required state recognition; the latter required a sufficiently inclusive unification scheme to make the emergence of a successful competitor society unlikely. Public accountancy would certainly have been considered an insufficiently mature profession to justify state recognition at this stage, and a whole host of problematics has prevented this objective from being attained on numerous subsequent occasions (Shackleton and Walker, 2001; Walker and Shackleton, 1995). The achievement of closure at the organisational level, on the other hand, foundered on the horns of the dilemma unsuccessfully resolved by the leaders of the London Institute. Although they had become convinced of the need for unification, they remained opposed to the inclusion of 'country accountants' other than those who satisfied their preconceptions concerning the desirable characteristics of a public accountant. Given that they had doubts about many of the members of the provincial societies, it is unlikely that they considered unaffiliated accountants as being likely to satisfy those criteria. In essence, they were, both in the months leading up to the merger and thereafter, unwilling to adopt a sufficiently inclusive policy to give the desired organisational closure of the profession of public accountants a reasonable chance of success.

We will illustrate this deficiency below by demonstrating that the founder membership by no means comprised 'nearly all the leading public accountants in England and Wales' and that the newly formed SA, in 1885, was able to establish a numerically viable accounting body partly by recruiting in areas that the ICAEW failed to reach.

All leading accountants

To help assess the Charter petitioners' claim to have captured 'nearly all the leading public accountants in England and Wales', it is relevant to consider whether: (a) all members of the prior societies joined the ICAEW; (b) any prominent accountants remained outside the ICAEW at the date of organisational fusion. The evidence suggests that the claims of the petitioners were exaggerated.

Boys (2004:45) reveals that 26 members of the founder bodies –19 members of the Society (including three student members), five members of the Manchester Institute and two members of the Liverpool Society – did not join the ICAEW. It is fairly clear that some of these are unlikely to have been leading accountants continuing in practice long after the formation of the ICAEW. For example, W. Mathison of Liverpool retired from practice in 1880 as did J. Crowther and T. G. Watson of Manchester. G. Nesbitt of Manchester was not admitted to the ICAEW due to an impending trial that led to imprisonment. However some, such as E. H. Crossland of Liverpool and C. E. Edwards of the English Society, joined later (Boys, 2004:41, 42, 43 and 51). One or two of the English Society's non-joiners may have been working outside public practice and may have decided that the ICAEW would do little for them, but 13 of the 15 members not accounted for above were certainly in public practice in 1877 (Harper, 1877). Also, it is an intriguing question why four of the Society's Council members, all public accountants (Harper, 1877, and presumably prominent in their locality, failed to join. One plausible explanation is that they did not believe that the Society's members, including its former councillors, had fared well as the result of the merger negotiations.

Also relevant in assessing the petitioners' claim is our finding that the immediate post-formation period saw the admission of numerous accountants, many of them directly to fellowship status[26] and, therefore, people who were considered to be worthy of admission to the elite new body at the senior level.[27] These included G. W. Spence, who had been influential in encouraging the London Institute, 'for the sake of the profession and of the public, to widen its rules [in 1872] in order to admit "properly qualified" accountants' (Howitt,

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[26] Fellowship was the premier signal of fitness to practice, and we think it is reasonable to infer that the requirement for five years in practice as a public accountant was intended to confine the label to leading practitioners. At this early stage in the creation of a professional status for accountants, five years probably represented a significant period of experience.

[27] The importance attached to fellowship status is further reflected in the fact that it became a condition for election to the ICAEW's ruling body, its Council (Guildhall Library, Ms.28411, vol. 1: 110). This condition served as an effective bar to business members being elected to the Council. It was not until 1943 that the first member working in business (F. R. M. de Paula) became a Council member (Zeff, 1972:8).

1966:9). The 1880 equivalent of the earliest known firm of accountants that can trace its history down to the present day is Tribe, Clarke & Co. with, unusually, offices in London and four provincial cities (Bristol, Cardiff, Swansea and Newport, Mon.) (Boys, 1994:17). The firms' four partners, Wilberforce Tribe, Edward Gustavus Clarke, Richard Garnaut Cawker and Frederick George Painter were admitted to the ICAEW post-organisational formation in September–October 1880. Only one of the four partners in the prominent London partnership, Broads, Paterson & May, had been a member of the London Institute; the other three joined the ICAEW on 4 August 1880. Moving further around the country for examples, we find that partners in the following firms, all 'unqualified' at merger date, were admitted to the ICAEW at fellowship level over the next nine months: Armstead & Oakes of Sheffield;[28] Carlill & Burkinshaw of Hull;[29] Wenham Brothers & Agar of Birmingham;[30] and Wykes Brothers & Mantle of Leicester.[31]

The partners in two of the other six firms that have a continuous history dating from the eighteenth century through to the present day had not joined the ICAEW by 2 February 1881 (ICAEW, 1881), namely the Bristol firms Curtis, Jenkins & Co. (later merging with what is now PricewaterhouseCoopers) and James & Henry Grace (now KPMG). The non-joiners were not confined to cities where the prior societies had no direct physical presence. Josolyne, Clarke & Co. of Cheapside (now Ernst & Young) and Tansley Witt of Chancery Lane (now Deloitte) were established London practices containing well-known names that can trace their successor firm down to the present day.

Society of Accountants

The elitist attitude of the London Institute-dominated ICAEW continued to be the subject of critical comment in the accounting press post-organisational fusion (Howitt, 1966:29–30), and within five years the SA had been created, in the words of its chairman, to fill 'a void that the existing Institute does not fill' (quoted in Howitt, 1966:30). This paper suggests that part of that void was the lack of geographical coverage of the ICAEW, reflecting its origins and continuing arrogant stance towards 'country accountants' despite its claim to comprise 'a body representative of the whole profession'.

A comparison of the ICAEW's Register of Applications not Acceded To, 1880–1910, (Guildhall Library, MS28467) and the first List of Members of the SA (SA, 1885) reveals that 36 (11.9%) of the 303 founder members of the SA in England and Wales had previously been refused admittance to the new national association for accountants. Of these, no fewer than 33 were located outside England's capital city. Those excluded contributed 17 members to the inaugural Council of the SA, including its vice-president, Joseph Green from Warrington. Moreover, 195 (87.4%) of the 223 applications from accountants located in England and Wales, recommended for rejection by the Applications Committee of the ICAEW in the period up to the formation of the SA, were from provincial practitioners.

Consistent with the presumed objective of organisational closure, the formation of the SA was not welcomed by the ICAEW. Its Council minutes for 1885 record the fact that the General Purposes Committee had 'considered an advertisement of an application for a licence by the Board of Trade for the incorporation of the Society as a limited Co.' and resolved that 'it be a recommendation to the Council that the Solicitors be instructed to oppose the granting of such licence' (Guildhall Library, MS28411, vol. 2:55).[32] The SA was fully aware of the ICAEW's opposition, with its second annual report drawing attention to the fact that it had been 'boycotted by *The Accountant* (weekly journal) which, contrary to the established custom of the press, refused to insert even the Society's advertisement' (SA, 1886:4). It was of course that journal which described the SA as consisting of, 'a formidable array of clerks of all kinds – rent collectors, corn merchants, shopkeepers, valuers, collectors of taxes, bailiffs, secretaries of various concerns, civil engineers, school board clerks, overseers, timber agents, pawnbrokers and manure merchants'. (*The Accountant*, 20 March 1886:160)

The leaders of the SA countered the boycott by deciding 'to appeal to the public press generally', placing material in '*The Times*, the *Daily Telegraph*, *The Irish Times*, *The Citizen*, and other leading

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[28] John Armstead and Marriott Oakes were also brokers on the Sheffield Stock Exchange. According to its historian (Hoe, 1977:4), the Sheffield Institute's leading members were stockbrokers, reflecting the prestigious role of the Exchange within that city's commercial activities.

[29] J. G. Carlill founded the firm as early as 1835 (Howitt, 1966: 231), making it one of the older firms with a continuous history through to the present day, through merger with what is now Hodgson Impey in 1970 (Matthews et al., 1998: 304).

[30] One of the three Wenham Brothers admitted to the ICAEW in the second half of 1880, Alfred Ebenezer, is listed in a Birmingham directory of 1870, with the firm of Wenham Brothers & Agar appearing in 1874. Wenham Brothers had an office in the City of London by 1871. The Wenhams were called in by Pilkington Brothers in 1872 'to put the accounts upon the best commercial footing' (Barker, 1960: 170) and, from 1874, were responsible for preparing a twice-yearly balance sheet.

[31] The firm was joint auditor of the Leicester Tramways Company Ltd., a quoted company, in 1886 (Burdett, 1887: 1071), and possibly from the date of its date of formation in 1877.

[32] The SA succeeded in placing an advertisement in *The Accountant's Journal*, however, with this success referred by the Council of the ICAEW for consideration by the General Purposes Committee on 3 February 1886 (Guildhall Library, MS28411, vol. 2: 85).

Table 7
Geographical distribution of ICAEW and SA founder members

	ICAEW[1]		*SA*[2]	
	No.	*%*	*No.*	*%*
London	211	37.1	79	26.1
Liverpool	40	7.0	21	6.9
Manchester	92	16.2	23	7.6
Sheffield	42	7.4	13	4.3
Four cities	385	67.8	136	44.9
Rest of Lancs & Yorks	66	11.6	52	17.2
Sub-total	451	79.4	188	62.0
Rest of Eng. & Wales	117	20.6	115	38.0
	568	100.0	303	100.0

[1] Includes Wade and Guthrie
[2] The 306 founders of the SA included one person based in Scotland and two in Australia
Sources: ICAEW, 1881; SA, 1885; Boys, 2004.

journals throughout the country' (SA, 1887:3). The hand of the ICAEW was clearly judged to be behind the actions of *The Accountant* which, from 1891, styled itself as 'The official organ for chartered accountants throughout the world', with the SA's own publicity initiatives considered responsible for the following favourable outcomes:

> 'The result has been satisfactory beyond anticipation, and may be best judged by the following extract from a speech of the Chairman of a meeting of Members of the Institute of Chartered Accountants, held in London, on March 16th, 1887: – "There is, as you are aware, another Society of Accountants, which has been started recently, the governing body of which take every opportunity of bringing its existence before the public, week by week, and, in short, their management appears to be most energetic."' (SA, 1887:4)

It is widely agreed that the SA was formed to appeal to the constituency of accountants excluded from the ICAEW. For trainees, the restrictive practices of the ICAEW are generally expressed by the existing literature in terms of cost of entry – principals usually demanded a premium for taking on an articled clerk who was also required to serve an apprenticeship period of five years. For accountants eligible for admission on the basis of experience, membership was confined to those in public practice who offered only the core services associated with the work of a public accountant. Willmott is unusual in identifying exclusion on the basis of geographical location as a reason for the SA's formation[33] and, although we have no direct proof that this was the case, the fact that the ICAEW was a national organisation, in name only, certainly provided the SA with the opportunity to build up a viable membership by pursuing a broader-based national profile. It is also well-known that the SA extended its geographical recruitment strategy, not only by looking beyond England and Wales within the UK, but also through its '"British Empire" policy' (Garrett, 1961:14) launched in Australia in the autumn of the year that it was formed. In the remainder of this section we compare the distribution of the initial Council and the initial membership of the two bodies.

Composition of initial Councils

We have seen (Table 5) that 40 of the 45 members of the ICAEW's foundational Council were located in the four cities in which the five merging societies were based. Moreover, all 45 worked in just four counties. The SA's initial Council of 50 members (Table 5) exhibited certain similarities, which is unsurprising given that those four cities were where public accountants were most populous (Edwards et al., 2003) and the concept of the qualified accountant was most firmly established. Overall, however, the SA's Council membership was far more broadly based and, unlike the ICAEW, it was not City of London dominated. Just 13 (26.0%) of the members were located in the capital city, of whom a bare majority were located in the Square Mile. A further 11 (22.0%) Council members worked in Liverpool, Manchester and Sheffield, and 10 (20.0%) in other parts of Lancashire and Yorkshire. The 16 remaining Council members (32.0%) were spread over 12 additional counties, so that three and a half times as

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[33] There are signs, however, that this explanation may have been constructed on the basis of erroneously equating the London Institute with the ICAEW (Willmott, 1986: 566).

Table 8
Geographical distribution of ICAEW and SA members

	ICAEW 1880		*ICAEW 1885*		*SA 1885*	
	No.	*%*	*No.*	*%*	*No.*	*%*
London	211	37.1	541	36.8	79	26.1
Liverpool	40	7.0	79	5.4	21	6.9
Manchester	92	16.2	156	10.6	23	7.6
Sheffield	42	7.4	53	3.6	13	4.3
Four cities	385	67.8	829	56.4	136	44.9
Rest of Eng. & Wales	183	32.2	641	43.6	167	55.1
	568	100.0	1470	100.0	303	100.0
Four cities	385	67.8	829	56.4	136	44.9
Birmingham	19	3.3	111	7.6	5	1.7
	404	71.1	940	63.9	141	46.5
Rest of Eng. & Wales	164	28.9	530	36.1	162	53.5
	568	100.0	1470	100.0	303	100.0

Sources: ICAEW, 1881; ICAEW, 1885; SA, 1885; Boys, 2004.

many counties were represented on the SA's initial Council as on that of its elite predecessor.[34]

Composition of initial memberships

The initial memberships of both the ICAEW and the SA were distributed over the same number of counties (32), but it must be remembered that the SA was starting from scratch in creating a membership profile and that it had little over half the number of founder members as had the ICAEW. Significant differences become apparent, however, when we delve further into the statistics. Whereas 67.8% (Table 7) of the ICAEW membership was located in the four foundational cities, the corresponding figure for the SA is just 44.9%. Moreover, while just 20.6% of the former's members were located outside of London, Lancashire and Yorkshire, the proportion was nearly twice as high – 38% – in the case of the SA. It might be argued that this should be expected given that the ICAEW had already recruited heavily in those three areas. However, the scope for recruitment remained considerable, judging from the content of the trade directories (see Table 6, col. 2), and one might imagine a particular incentive for the excluded to join a new body where their local competitors already enjoyed the market advantage of institutional recognition. In other words, the new body might gain recruits who were keen to counter intra-occupational demarcation signalled by chartered status.

Table 8 expands Table 7 to reveal the geographical dispersal of the ICAEW's membership at the time that the SA was established (1885), and also contains additional geographical analysis. Although the membership in England and Wales had increased from 568 to 1470, the London cohort had grown at an almost identical rate, so that it continued to account for approximately 37% of the total membership. We can see that the proportion of the membership located outside the four cities had risen from 32.2% to 43.6%, but it still lagged well behind the SA's figure of 55.1%. It is also the case that the increase in the proportion of membership located in the 'Rest of Eng. & Wales' was mainly attributable to a greater presence in a small number of large cities, particularly Birmingham.[35] When the figures are re-worked by adding the Birmingham numbers to the four cities we find that, even in 1885, the ICAEW's 'Rest of Eng. & Wales' percentage at 36.1% trails further behind the SA's 53.5%.

9. Concluding remarks

This paper shows that public accountants throughout England and Wales saw much greater benefit to be gained from joining the national organisation established on 11 May 1880 than from seeking membership of predominantly city-oriented societies formed during the previous decade. Focusing on changes in the membership roll from the time that merger was first seriously mooted, at the beginning of 1879, we find a membership of 483 that rose by 29.4% over the next 16 months (derived from Table 1). The vast majority of these – 598 out of 625, or 96% – exercised their option, under the charter of incorporation, to participate in organisational fusion. We have also noted that the ICAEW's numbers continued to rise at an annualised rate of over 100% in the nine months following the merger. These events appear to comprise indisputable evidence of an enthusiasm amongst England's public accountants to be included in a national organisation that had conferred upon it privileged public status through state recognition. Such enthusiasm may be explained on the grounds that the rank and file, in common with the leadership, saw more potential for a national organisation to pursue, successfully, a professional project (Walker, 2004b:29).

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[34] There had been no significant broadening of the geographical composition of the ICAEW even by the time the SA was formed. Indeed, the ICAEW had 30 principally London-based Council members in 1885 (though eight also had offices elsewhere), with ten others based in Lancashire and Yorkshire (ICAEW, 1886).

[35] Other significant increases occurred in Bradford (up from 8 to 21), Bristol (6 to 28), Cardiff (1 to 19), Leeds (5 to 22), Leicester (6 to 18) and Newcastle (5 to 27).

A professional project seeks to secure control over a market for specialist skilled labour in order to raise the status, standing and financial rewards of its members. To help achieve these objectives, the collective may pursue a policy of 'closure' which, according to Macdonald, involves 'the definition of membership at a particular point in time, and the setting of criteria for deciding who may join subsequently' (1985:113). In deciding on eligible membership, it is necessary to address 'the dilemma of exclusiveness versus market control' (Macdonald and Ritzer, 1988:257), and it was because of failure on the part of the ICAEW's leaders to address effectively this predicament that a unique opportunity to achieve organisational closure of the public accountancy profession in Britain was missed.

To explain the leadership's failure to achieve organisational closure, we have examined the composition of the leadership group consistent with the conviction that 'institutional deeds and outcomes derive from the behaviour of individual actors, particularly those key players who drive the creation, policy development and outlook of practitioner associations' (Carnegie et al, 2003: 790). The move towards merger was led by the Council of the London Institute which, although it had become more outward-looking as the result of a 'progressive element' gaining power in 1877 (Howitt, 1966:14), remained a City of London-dominated set committed to the vision of a profession confined to what it judged to be bona fide public accountants. Naturally, it is not always the case that an elite succeeds in getting its own way. Indeed, Walker (2004b) reveals that the leaders of the London Institute were forced to compromise in order to achieve state recognition for the national body in 1880. Anxiety amongst the leadership was particularly directed at the inclusion of accountants who also undertook non-accounting work, but the conclusion eventually reached was that the admission of all prior members of the merging societies was a necessary price for achieving state recognition and, we argue, the possibility of closure of the qualified segment of the accounting occupational group.

Merger arrangements relating to the award of fellowship as compared with associateship status[36] ensured domination by the London Institute within the senior category of the ICAEW's membership. When other City of London-based accountants are included in the calculations, we reveal domination of the ICAEW's first Council (Table 5) and main committees. The elite London Institute also negotiated 44% of the seats on its first Council, including the positions of president and vice-president, despite accounting for just 31% of the combined membership (Table 3). The London Institute also supplied the bye-laws initially used by the ICAEW, its headquarters (3 Copthall Buildings, 1877–93, Howitt, 1966: 16, 205) and its presidents for the first 16 years of its existence. We can therefore conclude that the London Institute was the dominant partner in the newly-established body and that its members exerted control over the affairs of the national collective for some years afterwards.

The paper also uncovers a previously unidentified consequence of the *modus operandi* for creating a national organisation that soon proved problematic. According to Guthrie and Wade, the Accountants' Incorporation Association that they created was designed to protect 'the interests of those [accountants] not members of any existing accounting body'. There is no evidence that anyone other than the two founders initially gained anything from its formation, however, with the result that geographical coverage of the new body was patchy, mirroring the fact that four of the five merging societies were, substantially, single city-oriented. More than three-quarters of the newly enfranchised, self-styled, chartered accountants came from London, Lancashire and Yorkshire, producing a form of exclusion of accountants located in other geographical areas that diminished the possibility of achieving organisational closure based on possession of chartered credentials.

This deficiency might have been overcome by the ICAEW mounting, immediately, a policy of actively recruiting public accountants from under-represented areas. There is no evidence in the archives to indicate that the leadership considered it necessary or desirable to mount such a campaign, and our analysis of new enrolments in the period up to the formation of the SA is consistent with the absence of any such initiative. And while it is true that the ICAEW's Council arranged listings of its membership in the 'Accountants' Diary', we interpret this action as an attempt to raise public awareness of the existence of an elite grouping of public accountants rather than as a recruitment drive, though it might be expected to have had some marginal effect in that direction. Moreover, our analysis of the 'Register of Applications not Acceded To', for the period from formation to the appearance of the SA in 1885, reveals the fact that the vast majority of rejected applications were from public accountants working in the provinces. These findings, we conclude, support our conviction that the ICAEW remained an elite body relatively unconcerned to recruit 'country accountants'.[37]

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[36] Clause 4 of the Charter provided for: all members of the first Council to be fellows of the ICAEW; all remaining fellows and associates in the merging societies to carry the same status within the ICAEW; members of the Liverpool Society (which made no distinction between fellows and associates) 'who have been continuously in practice as Public Accountants for five years' prior to the charter date to be fellows of the ICAEW, with its other members becoming associates (ICAEW, 1881: 202–3).

There were of course other important factors which rendered organisational closure unlikely. The conditions for admission to membership constructed by the national body were non-trivial. Young men could qualify only if they were able to obtain a position with a chartered accountant in practice, serve a five-year articled clerkship (three years for a university graduate), pass written and oral examinations, and overcome severe financial barriers. The family of an articled clerk had to pay a premium which was usually at least 50 guineas and could be as much as 300 guineas (*The Author*, 1886:29; *The Accountant*, 27 February 1892:185), while the trainee would rarely receive a salary. If an apprentice eventually qualified, he had to pay a further 10 guineas entrance fee to gain admission to the elite cohort. Turning to admission on the basis of prior experience, a public accountant was required to prove, to the satisfaction of the Council, that he had been in practice for at least five years. Also, the range of permissible activities was significantly more restricted than for the founders for whom, as we have seen, compromises were made[38] in order to achieve organisational fusion. The elitist stance of the ICAEW's early leadership represents, therefore, a reassertion of the policy priorities of the London Institute.

We know that the leaders of the London Institute had shown an interest in occupational closure prior to organisational formation, and the fact that the ICAEW mounted a state-registration initiative in the 1890s, following the emergence of a significant competitor society, is consistent with our view that incorporation by Royal Charter was expected to achieve occupational closure at the organisational level. At the very minimum, we imagine that those responsible for constructing the merged body would have considered it inconceivable that another body could emerge to challenge its hegemony. This is not how it appears with the benefit of hind-sight of course. As noted earlier, Howitt records that the ICAEW's exclusive policies left the way open, just five years later, for the SA to fill 'a void that the existing Institute does not fill' (Howitt, 1966:30). A prolonged and unresolved history of 'internecine warfare' has ensued (Stacey, 1954:84; see also Macdonald, 1995:195; Walker and Shackleton, 1995:499; Shackleton and Walker, 2001).

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[37] One early sign of a possible change of policy, following formation of the SA, was the decision announced to the 1885 annual general meeting to hold autumnal meetings of the ICAEW in the provinces, starting with Manchester in 1886 (Guildhall Library, MS28411, vol. 1: fo. 58).

[38] A 'grandfather clause' (Macdonald, 1995: 131) contained in the Royal Charter (ICAEW, 1881: clause 21), which permitted founders to continue to undertake non-accounting work in which they were engaged at the merger date, such as auctioneering, created tensions between themselves and those subsequently admitted who were denied this privilege (Anderson et al., 2003).

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A grounded theory of corporate disclosure

John Holland*

Abstract—This paper outlines a grounded theory of corporate disclosure comprising, disclosure choices, the story of value creation and intangibles, managerial optimism and opportunism, benchmarking, and of continuous corporate interaction with stock and information markets. The disclosure activity led to cumulative corporate learning about perceived market outcomes and their 'fragility'. This was reinforced by fund managers during subsequent one to one meetings. The interaction and learning fed back into cumulative corporate understandings and experiences (priors) of their disclosure behaviour which then became drivers of subsequent disclosure. These interactions and the corporate responses revealed the dynamic element to corporate disclosure behaviour. The emphasis on choice, private disclosure, knowledge intensive intangibles, stories, benchmarking, feedback, learning, outcomes, response and many other elements in the theory are interpreted as tentative means to deal with a new enhanced information asymmetry which can be considered to be at the heart of the disclosure and valuation crises observed in financial markets in the period 1997–2003. The research was conducted through case interview field work in 25 large UK companies during 2000 and use was made of archival sources. A grounded theory approach was employed in processing the data. The results were discussed relative to relevant literature and to previous grounded theory of corporate disclosure behaviour. Areas for further research were identified.

Gibbins et al. (1990) developed a grounded theory of disclosure for medium sized Canadian companies in the 1980s. Field research work by Holland (1998), Holland and Stoner (1996) suggested that such a grounded theory might be underlying UK corporate behaviour. The aim was to explore this possibility in a City of London financial centre context for large UK companies. As a result the research question concerned the following. How do large UK companies voluntarily disclose information through private and public channels and how does this learning experience change their disclosure behaviour? The paper begins in Section 1 with a brief summary of the literature. In Section 2, the research methods are discussed. In Section 3, the grounded theory of disclosure behaviour is briefly summarised. Section 4 outlines the major corporate disclosure choices in one period comprising common public, private and secrecy choices. This section also covered priorities in choices, and opportunistic behaviour. Section 5 outlines the role of the story and benchmarking in disclosure. Section 6 describes corporate perceptions of interactions and outcomes in the market for information and the stock market. Section 7 explores how corporate learning about, and perceptions of market outcomes, created a learnt context or priors which influenced current and future disclosure. In Section 8 the overall grounded theory is discussed relative to literature on previous grounded theory. Areas for research are identified in Section 9.

1. Literature review

There has been much discussion within the literature as to what drives public corporate disclosure. Schipper (1989) reviewed the range of influences on the timing, information content, volume and quality of disclosed information. Revsine (1991) outlined the incentives management have for the control of disclosed information. Lev (1992) discussed how companies could design and implement corporate disclosure strategy. There have been few studies which have directly interviewed or observed management in an attempt to explain the details of corporate disclosure behaviour and to develop more complex models of corporate disclosure. Gibbins et al. (1990) is a rare exception. The authors employed a grounded theory approach to understanding the broad drivers and components of corporate public disclosure behaviour. Holland and Stoner (1996) adopted a grounded theory approach to explaining corporate disclosure of price sensitive information. Holland (1997, 1998) developed an embryonic model of corporate disclosure behaviour set in a UK context. As a result, a primary aim of this research was to further investigate the detailed character of corporate disclosure behaviour within the context of large UK companies operating in London as a major international financial centre. The work of Marston (1996), Barker (1997), Holland and Doran (1998),

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Holland and Stoner (1996), and Holland (1997, 1998), have indicated that private corporate disclosure was the dominant means by which companies sought to disclose qualitative information on intangibles. Holland (2001) revealed how fund managers emphasised the significance of intangible or qualitative factors in company valuation. As a result, this new field research was also extended to consider the role that qualitative information (on intangible and tangible assets) played in the broader form of corporate disclosure behaviour identified by Gibbins et al. (1990) and Holland (1997, 1998).

2. Research methods

Given previous research and the nature of the research questions on disclosure, a grounded theory approach was used to process the case data. It is difficult to investigate linked, interactive corporate disclosure behaviour by 'arms length' research methods such as analytic modelling or event studies. Given the research question it is necessary to get as close to the phenomena as is possible to collect data on the primary corporate disclosure elements and how they are linked. As Gibbins et al. (1990:122) argue, the grounded theory method 'helps to ensure that the variables and relations developed describe the experiences of those who make disclosure decisions'. Locke (2001) notes that grounded theory research is concerned with the discovery of theory and knowledge through an iterative process between data and emerging constructs. This inductive, pattern seeking methodology allows a researcher to both develop a theoretical account of the underlying phenomena and also to ground such an account in the case data employed. Ryan et al. (2002:155) argue that in 'case study research it is important to know that the researcher has adopted appropriate and reliable research methods and procedures' and 'in case study research we replace the traditional criteria of internal validity with the notion of contextual validity which indicates the credibility of the case study evidence and the conclusions drawn from them'. The latter criteria are critical for assessing the interpretative research reported in this paper and the following paragraphs seek to provide the reader with assurance on these matters.

The research was conducted in two stages. Stage 1 of the research involved collecting archival data on corporate disclosure by each case company. The most recent financial statements, public announcements, and presentations to analysts were collected directly from the company prior to the interview. Web-based sources became important archival sources during 1997–2000. Public announcements were identified from a variety of sources, including the company, and the London stock exchange. Media such as the *Financial Times* were available on databases. Stage 2 involved interviews with managers in 25 UK companies in the period to August 2000 to November 2000. The UK companies represented 20 FT sectors. Twenty-two companies fell within the FTSE 100 size group, two were in the FTSE 101 to FTSE 200 group, one was in the FTSE 200 to 250 group (See Table 1, Appendix 1). Twenty of these companies had already been extensively interviewed on broadly the same issues from 1993 to 1997 (Holland, 1998) and formed a further set of archival data on the content of the private disclosure agenda

Although this sample of companies provided a relatively high proportion of companies from the FTSE 100, the aim was not to provide 'statistical generalisation' as in more conventional hypothetical- deductive research (Ryan et al., 2002). The aim was to generate enough company cases to create the conditions for 'theoretical saturation' as recommended by Strauss and Corbin (1998:143) (i.e. the point in category development at which no new properties, dimensions, or relationships emerge during analysis). Similar sample sizes had proved sufficient in previous related grounded theory work (Holland, 1998) to produce case data with continuous repetition of the same kind of narratives about disclosure. Senior company managers were the only individuals interviewed. Their time was scarce and this restricted the interviews from one-and-a-half to two hours' length in each organisation. Financial communications to stock markets is dominated by a narrow, closed, small group of people at the top of large UK companies (Marston, 1996). These include the chairman, chief executive, finance director, and financial communications specialists. Table 1 (see Appendix 1 p.265) reveals that all interviewees were members of this insider group. The interview questions (see Appendix 2 p.266) were semi-structured and designed to allow the participants to interpret and describe the phenomena in their own way (Bryman (1988), Buchanan (1993)). Previous grounded research work helped define these questions (Holland, 1998). The company managers were asked to discuss their disclosure behaviour with core fund managers and others in the market for information. The focus was on disclosure in this common context for the listed companies. Sector specific disclosure to specialist regulators in say banking or transport was not investigated. Taping was not employed due to the sensitivity of the topic. Confidential case studies were prepared within 24 hours from detailed notes made during the interviews with the senior executives.

McKinnon (1988) and Stoner and Holland (2004) argued that explicit strategies should be developed to counter threats to validity and reliability while collecting data in field studies. In this research, counter checks were made between the interview data and archival sources, where available. These included checks against corporate presentation slides or against archival sources for publicly observable events such as mergers or financing episodes involving the companies. Multiple cases offered opportunities to explore how other companies viewed such disclosure related events for another case company. Parallel research work with fund managers over the same period (Holland, 2001, 2004b) provided opportunities to cross-check corporate views on disclosure content, behaviour, and feedback processes and revealed similar story and benchmark constructs.

During the processing stages the interview responses of the various subjects were compared, continuously sampled, coded, and compared to each other, using the constant comparative method as recommended by Strauss and Corbin (1998). Sampling was conducted until theoretical saturation was reached, or when new information produced little or no change to the codes or conceptual categories identified. That is when no new properties, dimensions, conditions, actions/interactions, or consequences were seen in the case data (p136). These resulting codes were then checked to demonstrate that they were connected to original quotations in the source material and thus provided grounding. Codes such as 'private disclosure', the 'company story', or 'understanding state', or 'fragility' were therefore grounded in the original case data. The refined code networks were then used to suggest theoretical constructs and associated maps of causal elements that were constructed into a theory of corporate disclosure in the information market context (Strauss and Corbin, 1998). An embryonic version of the grounded theory (Holland, 1998) was used for theoretical sensitivity purposes when processing the new data, as well as insights from matching FM data (Holland, 2001, 2004b).

3. Presentation of grounded theory and use of literature

Locke (2001, ch.7) comments that 'the presentation of grounded theories similarly follows a format that involves the telling of theoretical elements and the showing of data fragments that instance them' and 'This format can be outlined as: summarise the theoretical frame –serially present each theoretical element well illustrated with data instances – summarise the theoretical frame'. In this section the theoretical frame of the grounded theory of disclosure behaviour is presented as a 'paradigm model' as recommended by Strauss and Corbin (1998:130). This is a conceptual analytic device for organising data and for integrating structure with process (1998:142) and for summarising the grounded theory of disclosure behaviour. The paradigm model reveals how the grounded theory elements are connected, and thus provides a 'map' to steer through the ensuing detailed results Sections 4 to 7. It should however be noted that the paradigm model is an aggregate 'result' of these detailed results. Case quotes are used throughout these sections to illustrate these elements through interviewees' voices and thus ground the theory explicitly in the case data. The paradigm model was:

> 'The phenomenon of interest was corporate disclosure behaviour involving dynamic interactions with the market for information and the stock market. The context was the market for information made up of companies, analysts, fund managers and other security market information users and producers. The causal conditions influencing behaviour included companies' needs to continuously communicate with fund managers and analysts in the market for information, the corporate reporting cycle, ad hoc events, and market feedback responses to corporate disclosure. They also included knowledge intensive changes in corporate value creation processes. Diagram 1 reveals the initial action strategy involved dynamic corporate choices between public and private disclosure and secrecy. It consisted of a direct and responsive dialogue between a select group of top company managers with individual (major shareholder) fund managers and influential analysts. Cost benefit calculations were at the heart of such choices. Diagram 2 illustrates the wider interactions. It indicates how a story or narrative of corporate value creation (X), combined with benchmark information on the role of key intangibles, was central to this disclosure behaviour. Opportunism and bias were evident in many dimensions of this corporate disclosure behaviour. Growing shareholder wealth maximising pressures and price feedback provided an important context for disclosure. This disclosure led to perceived changes in information asymmetry and in market outcomes. The feedback and dialogue created opportunities for (multi period) cumulative corporate learning and for changes in corporate perceptions of resulting market states. The companies perceived two related information market states which were fund manager and analyst understanding (Y1) and confidences (Y2) states concerning the company value creation story and corporate disclosures. These states were the outcomes of a fund manager (and analyst) process (Y3) using concrete & subjective evidence to test the company story (X), and to check promises. Major barriers and problems (Y4) were observed in this process. The understanding and confidence states were perceived as acting as informed contexts for understanding new information or events and were thought to play a central role in valuation. However these states were very fragile with respect to company surprises (Y5) and to changes in market sentiment

> (Y6).The companies perceived that individual fund managers and analysts intermediated this company specific information into consensus understanding and confidence states and then into stock prices and into other stock market states such as volatility, liquidity, and bid offer spreads. Changes (sudden and gradual) in stock market states were often the first observable feedback signal that problems or opportunities were being recognised by markets in the execution of the corporate value creation story and in disclosure behaviour As a result the stock market reaction to corporate disclosure as well as to sector and stock market movement were continuously closely monitored. Cumulative learning over time generated stable corporate priors (P) or learnt preferences for corporate disclosure choices, content, behaviour, structure, process, as well as for responsiveness and persistence built in to these priors. Visible use of priors was a signal about financial communications quality. The intended consequences included improvement in corporate capabilities and perceived market states (outcomes). These included, inter alia, improvements in corporate responsiveness and disclosure capability (via the learnt priors), in fund manager and analyst understanding and confidences states, in corporate reputation for disclosure behaviour in the market for information, and in the generation of a stock price information set that reflected the economic activities of the company.'

Locke (2001, ch. 7:120) also points out that there is a problem of how to use the literature in the presentation of grounded theory. The presentation of literature in the early phases of the paper 'mimics the hypothetico-deductive approach in which theory is a priori. She comments: 'But what happens to how we write the literature when we begin with empirical data and hold existing knowledge in abeyance until our theoretical frameworks are well established?' She argues (p.121) that 'the answer seems to be that the literature which establishes the phenomena to be investigated still appears at the beginning of the manuscript, even though it may be pre-empted by a sneak peek into the investigated scene'. And: 'However, writing the literature in grounded theory differs from the traditional model in that literature is sometimes integrated into the presentation of the model in what is usually the "findings" section of the manuscript. ...Furthermore, the relationship between their grounded theoretical frame and a broader literature to which it makes a contribution is sometimes a problematic issue, because the research questions are not usually framed in terms of existing theory.' The literature is employed in this paper in three senses. In Section 1 the literature is used to establish the phenomena and problem area to be investigated. Each major results section (4 to 7) contains a succinct summary of the case results set within key grounded theory themes or elements, and these are both discussed within relevant literature. Finally, the overall model is discussed within relevant literature in Section 8.

4. Model in one period – choices between public and private disclosure and secrecy

This section outlines the corporate disclosure choices identified by the case companies. In any one period, each case company faced a series of choices between public and private disclosure and secrecy, as well as decisions on the use of information reserves, and how these choices and decisions reflected constraints. These choices are illustrated in Diagram 1.

The following case quote reveals that priorities were established in the cases between these choices.

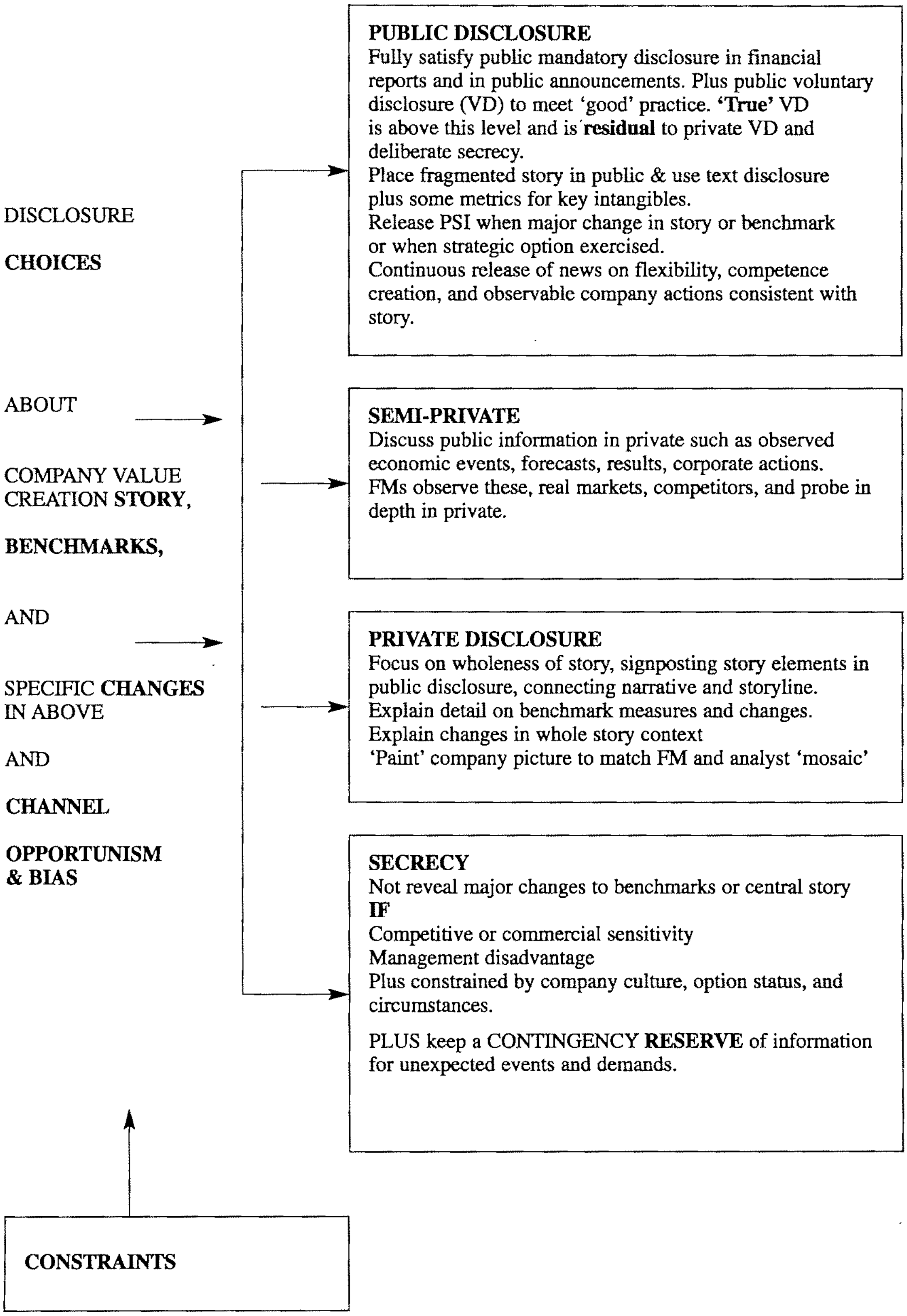
> **Case insurance company:** 'Our disclosure priorities are, one, to meet the regulatory requirements in financial report and in our announcements to the stock exchange. Two, to exceed these public disclosure levels by meeting standards for good practice and, where necessary, release extra information that is very important to the value of this business, subject to regulation. Three, we manage our private communications with fund managers and analysts and here again, there are external benchmarks in terms of good practice. There is also a benchmark in terms of what we said last year and the previous promises we have made and, therefore, we must develop information relative to these. So, in terms of private disclosure through these one-on-ones, we expect to exceed these benchmarks. ......We give out as much as we can without breaking any confidentiality restrictions or breaking price sensitivity rules. Beyond these disclosure issues is number four, the issue of confidentiality and we will not cross this confidentiality and commercial disadvantage line.'

4.1. Public mandatory disclosure and voluntary disclosure

In the cases, the companies managed public mandatory disclosure and public voluntary disclosure first. They had no choice on ASB or FASB mandatory requirements for financial statements. The UK Listing Authority and UK stock exchange disclosure requirements (1994) for price sensitive information (PSI), and the SEC Fair Disclosure rules (August 2000) were the main external standards for public (announcements) disclosure outside of the reporting season. PSI was released quickly into the public domain and information was also released to ensure that there is not a false market in the companies' shares.

Management then sought to voluntarily disclose

Diagram 1
Model in one period



DISCLOSURE

CHOICES

ABOUT

COMPANY VALUE
CREATION **STORY**,

BENCHMARKS,

AND

SPECIFIC **CHANGES**
IN ABOVE

AND

CHANNEL

OPPORTUNISM
& BIAS

PUBLIC DISCLOSURE
Fully satisfy public mandatory disclosure in financial reports and in public announcements. Plus public voluntary disclosure (VD) to meet 'good' practice. **'True'** VD is above this level and is **residual** to private VD and deliberate secrecy.
Place fragmented story in public & use text disclosure plus some metrics for key intangibles.
Release PSI when major change in story or benchmark or when strategic option exercised.
Continuous release of news on flexibility, competence creation, and observable company actions consistent with story.

SEMI-PRIVATE
Discuss public information in private such as observed economic events, forecasts, results, corporate actions.
FMs observe these, real markets, competitors, and probe in depth in private.

PRIVATE DISCLOSURE
Focus on wholeness of story, signposting story elements in public disclosure, connecting narrative and storyline.
Explain detail on benchmark measures and changes.
Explain changes in whole story context
'Paint' company picture to match FM and analyst 'mosaic'

SECRECY
Not reveal major changes to benchmarks or central story
IF
Competitive or commercial sensitivity
Management disadvantage
Plus constrained by company culture, option status, and circumstances.

PLUS keep a CONTINGENCY **RESERVE** of information for unexpected events and demands.

CONSTRAINTS

enough information to satisfy market or external benchmarks for public corporate communications. Benchmarks included requirements for textual disclosure from the UK's Operating and Financial Review (OFR) (Management's Discussion and Analysis (MD&A) in the US). They also included regular public ranking of corporate disclosure quality by survey companies interviewing analysts and FMs, and by members of the Investor Relations Society (2003) assessing companies. Corporate governance rating systems also include explicit corporate disclosure ratings (Sherman, 2002). Such voluntary public information release was substantial during periods of good corporate performance and was reflected in extensive use of images, text, graphs, and flow charts in a variety of media including the OFR, web pages, employee information and other public disclosure channels.

The case companies dealt with public disclosure first. They responded to market and regulator determined benchmarks for good practice in disclosure behaviour and content. The aim of voluntary public disclosure behaviour was to satisfy 'voluntary' good practice guidance and market benchmarks. This norm-based 'voluntary' disclosure often consisted of a significant volume of quality disclosures and was substantial during periods of good corporate performance or of stability for a case company. The aim of public voluntary disclosure was also to provide additional 'true' voluntary disclosure over and above such norms. This information was voluntarily released in an opportunistic way in public but was considered by the case companies to be fragmented in terms of telling the full value creation story. However, it allowed an extensive private debate to occur and created maximum degrees of freedom for private voluntary disclosure. It also created opportunities to 'paint the whole picture' in private. Thus public voluntary disclosure had both a 'norm' element and a 'true' element. The latter was residual in the cases and was determined by a complex, dynamic disclosure process involving secrecy, private disclosure and public disclosure choices.

4.2. Semi-private disclosure

The financial reporting cycle was a primary driver of an associated cycle of private one-to-one meetings with core FMs (Holland, 1998). The case companies used the meetings to discuss public domain information. This included observed economic events and public forecasts, changes observed by the core FMs in real markets and competitors, and recent financial results. The case companies were also aware that FMs and analysts exploited sector specific disclosure systems where this information was made public via, say, bank or transport regulators. The meetings were used to 'signpost' these less visible public sources to a wider set of users. The private meeting were used to expand the FMs' understanding of this public domain information and issues, and to explore the impact of external events on corporate performance.

4.3. Private disclosure to core FMs and to influential analysts

The case companies also used private disclosure to exceed public disclosure levels. The companies were aware that core FMs and analysts sought a unique information advantage and there was no point to the private meeting unless this occurred. The underlying basis for such a release of additional information was based on the idea of 'relationships' or implicit contracting between the company managers and the FMs where the parties exchanged capital, information and influence (Holland, 1997) for their mutual benefit.

Formal presentations were normally conducted in private one and one meetings just after the quarterly, half year, or annual results announcements. They focused on concrete measures of financial performance and strategic achievement. Targets for growth in margins and in EBITDA for major businesses in the group could be discussed. Growth in sales in product areas, and increased usage of new distribution channels, were also popular topics. In Section 5 we will see how companies used their value creation story and benchmarks to release information on intangibles such as the quality of brand management and of customer relations. The presentations used methods such as Powerpoint, and made extensive use of time series graphs for measurable variables such as margins. Photographs and flow charts of central parts of the operations, such as a new supply chain technology, new distribution channels or new products, were interspersed between the figures and used to provide variety and visual insights into the company story. Written text was used, but was subsumed under the slide summaries, and subsequently expanded on the website and in the OFR in the corporate report.

Where the case companies had full control over the voluntary disclosure agenda in the text in OFR text, graphs, flow charts, and images, they tended to 'look on the bright side' and present an optimistic view of the future. This control was potentially at its highest in voluntary disclosure in their private meetings with analysts and fund managers. Despite the mutual exchange benefits, the case companies' preference was to control the presentations and disclosure in private. Common text, graphs, flowcharts, and images were employed in the private meetings (large group presentations, and one-to-ones), and in the eventual published report, with the latter normally containing a subset of the material used in the private meetings. The case companies recognised that they would prefer to disclose little or no information on downside risk areas such as possibilities of major losses. In

Section 6, we see how market forces controlled this behaviour.

4.4. Secrecy

Issues of secrecy, confidentiality, and loss of competitive advantage were major factors in driving (or not driving) corporate disclosure behaviour.

> **Case bank:** 'Why do we need the investor relations profession in the bank? The Bank was really unaware of the need to communicate this kind of thing. It had a willingness to tell the truth but its idea of the truth was a very limited supply of information........This problem has been made worse in recent years because of the increasing significance of intangible sources of value in banking. ...You can think of many factors driving corporate secrecy. One of them is willingness to communicate which is based upon the culture in the organisation and we are a poor example of this. Another factor driving secrecy policy would be the 'boffin' factor. The more knowledge intensive and the more invisible the value creation process, and the more difficult it is to communicate. This may well affect secrecy. Another factor would be the complexity of the organisation. So, a conglomerate spread across many businesses may be an issue here. Ease of imitation of innovation may also be a factor in affecting secrecy.'

The creation of strategic flexibility or options was critical to the case companies. The case companies only released flexibility information when they exercised the choice built into the option, especially if this involved price sensitive information (PSI). During the creation of strategic options, the case companies kept the details a secret, and occasionally privately signalled the broad thrust of the strategic option being created. However, the case companies were careful to avoid release of false information, especially false PSI.

> **Branded goods company:** 'Only one or two of the strategic options that I have talked about may be our future. We don't know which ones are going to work. As a result, we are very careful about talking about these experiments that we are trying. ....For example, in our Internet experiments recently, a teenage website fell over and we think there is a good chance of failure with many of these experiments and it may be one in twenty that will succeed. When we experiment in this way we need to be cautious with the fund managers because as soon as we start talking about any one of these experiments the fund managers immediately think it may be a star. They boost expectations, the price goes up and is followed by a big disappointment. We, therefore, talk very generally about these and explain the downside and explain that they are experiments and that we are waiting to test them out on a larger scale before we can be sure how they are going to play a role in our general strategy...... It is only when we have a success that we will want to talk about it seriously with the analysts and the fund managers so they can build it into the price.'

The scale of secrecy and of information reserves were revealed when the case companies faced four situations. The first case was when they had to go to their core FMs to ask for help in say a financing issue and the case companies voluntarily released considerable amounts of additional information in private. This flow became a flood when a takeover battle broke out and the case companies faced a highly compressed period of 90 days when they had to persuade their core FMs that they were the best management team to manage the combined or separate sets of assets. Frequent private meetings were the common practice during contested takeover activity.

> **Case bank:** 'During a hostile takeover bid, the battle for control is also a contest of ideas and these are the reasons for the dramatic increase in the flow of information between us and fund managers. The private debate between us and FMs is competitive as the target company or other acquirers are doing the same thing. New information is created about the quality of the competing management teams, their ability to manage the corporate assets, their vision for value creation. We have to repeat our presentations to fund managers many times over during the takeover period and this can be a very boring and taxing experience for us. The quality of our financial communications skills is critical during this period to ensure that our takeover agenda is clearly communicated and we can respond to changing circumstances during the takeover period. When the FMs have to make up their mind, they do so on the basis of the track records of the competing companies before the takeover period, and on what they have learnt during takeover bid process.'

In other circumstances when performance declined and FM relations deteriorated, then the private voluntary disclosure declined. The internal information reserve was also used as a buffer to ameliorate unexpected bad news arising from unanticipated events or to support unexpected but positive developments. Thus we see secrecy, use of reserves, and private disclosure behaviour varied considerably with corporate circumstances and were driven by managerial opportunism. The residual or 'true' voluntary disclosure element varied considerably between situations of normal circumstances (good financial performance, few corporate problems) and high disclosure situations when seeking additional market-based finance (debt or equity) or during takeover battles. This enhanced public voluntary disclosure increased opportunities for further private disclosure. When the case company management were asked if this was opportunism or secrecy they denied it. However, the ebb and flow of voluntary private and public disclosures suggested otherwise.

4.5. Summary of the theoretical frame and relevant literature

The single period version of the grounded theory reveals that secrecy dominated private voluntary disclosure, because of commercial and competitive confidentiality and the status of strategic options. In addition private voluntary disclosure dominated 'true' public voluntary 'disclosure, because of the private exchange or implicit contract benefits between companies and FMs, and between companies and analysts. The case companies worked from the public disclosure benchmarks first, and then from the private disclosure benchmarks, with the ultimate aim being to control information for company and managerial benefits. Thus the release of further information was driven by secrecy, private exchange, and public disclosure aims. Opportunism was revealed in the priorities for disclosure and the way secrecy was altered with changing circumstances. The companies also had a bias towards optimism in their disclosure behaviour and content. The cases revealed a cost benefit basis to the overall voluntary disclosure choice. This involved costs which matched theoretical categories of costs of information production, and of proprietary costs of disclosure (Healy and Palepu, 2001). This also included a range of perceived benefits of disclosure in information markets (e.g. reduced information asymmetry), stock markets (e.g. narrower bid offer spread, higher liquidity), and corporate feedback benefits (e.g. reduced cost of capital). These decisions were subject to many constraints arising from reporting standards, stock exchange rules, corporate financial communication capabilities, confidentiality and competitive issues, as well as varying internal cultures of secrecy and tendencies to opportunism.

Important theoretical explanations of corporate voluntary disclosure lie in the concepts of information asymmetry and principal-agency contracting (Healy and Palepu, 2001). Companies voluntarily disclose information to reduce the information asymmetry and to minimise the agency costs of equity subject to (information) proprietary and production costs. In the implicit contracting or 'relationship' behaviour observed in the cases the corporate aim was to use public and private disclosure (and secrecy) to resolve the public and private information asymmetry subject to the negotiated cost-benefit satisfaction of both company management and of core external fund managers. The shared costs and benefits can be interpreted as a practical interpretation of the theoretical concept of 'agency costs of equity' in a relationship setting. In addition, the case based, cost benefit equation can be used also to explain the case company 'pecking disclosure order' whereby secrecy (benefits less costs) dominated private disclosure (benefits less costs), and how both of these dominated a residual public voluntary disclosure (benefits less costs) element. These cost and benefits were considered to change with increasing external financing needs. These concepts bear some relation to Myers and Majluf (1984) 'pecking order' theory of financing and of capital structure and suggest fruitful areas of research combining continuous disclosure and financing decisions. The above discussion reveals that concepts of information asymmetry, contracting, and cost-benefit analysis were viewed as being at the heart of voluntary disclosure and the grounded theory.

5. The private information agenda, intangibles, and the value creation story

The case companies covered a wide range of sectors that have been heavily exposed to radical knowledge intensive changes in corporate economic processes (Stopford, 1997). This in turn had a major impact on their disclosure agenda and exacerbated the information asymmetry between the case companies and suppliers of equity and debt capital. The company cases revealed that the use of value creation stories, of information about broad categories of knowledge intensive intangibles, and of benchmarking of intangibles set within the story, were at the heart of these attempts to find solutions to asymmetry and disclosure problems. The story content consisted of an oral or written narrative about how each case company created value through hierarchical, horizontal, and network value creation processes (Holland, 2004a). In the case companies, a specific group of intangible assets or qualitative value creation factors such as top management quality or coherence of strategy, were critical hierarchical or top down drivers of the value creation process. Each case company also articulated a concept or idea of its 'horizontal' value creation process consisting of sourcing decisions and processes, transformation decisions and processes, and output decisions and processes. Within this process the case companies exploited middle management and employee human capital, and other intangibles such as brands, quality of R&D systems, and customer and supplier relations. The case companies also exploited network value creation processes involving sharing of both tangible and intangible value drivers via customers, alliances, suppliers, and distributors, and these were mainly employed at the boundary of the firm. The nature of these value creation processes is discussed in detail in Holland (2004a).

> **Chemical company case:** 'We have a complex new story especially on the speciality chemicals side, the fragrance and food taste side, as well as on the paints side. This is about us developing value chains through from R&D, through technology applications, through to developing new product pipelines, through to our customer and our marketing and our brands. There is a new knowledge intensive value chain in this company that is different to the old bulk chemicals business. We need to tell this story and keep telling this story so the market will understand it. ......there is some resistance in the financial markets to our story. They see this as a bit of a black art. They are sceptical of the alliance between the creative element of our market end people, customer end people, and the technical knowledge of the chemists. Will we find the new kind of Chanel or new fragrance for the year 2005?'

In some cases the story had acquired a mythical status and remained unchallenged until major corporate problems or crisis emerged. This was a convenient short cut which saved research resources. It was only challenged when an event occurred which focused the attention of a large section of the information market on the 'star' company (Holland, 2004a). The story elements were also benchmarked in some way. Some intangibles such as the effectiveness of R&D could be inferred from absolute measures such as the absolute R&D spend, and by observed innovations. Other key intangibles could be identified, and their effectiveness could be ranked, implicitly or explicitly, on the basis of a FM or analyst subjective judgements, relative to competitors or the sector. Information was generated by privately observing and perceiving changes in relative benchmark indicators such as changes in the perceived ranking of management quality or of strategy relative to competitors.

> **Consumer goods case:** 'Some of these intangibles are benchmarked. For example, we won the 199X Investor Relations Award. This was for the effectiveness of our disclosure behaviour. The Investor Relations manager concerned was sacked by me shortly afterwards because I didn't think he was doing a good job so I disagreed with this external benchmark. My feeling is that we are still not getting over to the market the power of our brands. Our internal valuation is very much greater than the share price. We do an internal benchmarking of brand effectiveness but there is not much in the way of public benchmarking except by one or two survey companies. This means that the analysts cannot really check if there has been an increase or a decline in the brand effectiveness directly. However, they have other means of doing this. They can, for example, find that the sales do not meet the three or four percent growth target, say, in our confectionery or in our soft drinks business.'

5.1. Summary of the theoretical frame and relevant literature

This section has outlined two major elements of the grounded theory, whereby the story of value creation and the use of benchmarks are combined to communicate fragmented and qualitative information on the role of intangibles in corporate value creation. The case companies, and other information market participants, constructed the story (form) and benchmarking as means to overcome the information asymmetry arising from knowledge intensive changes in company value creation. These findings and the case disclosure content suggest that disclosure researchers should exploit broader literature. For example, (Boyce, 1996; Boje, 2001) discuss the role of stories within internal corporate communications. In this literature story telling is used as a vehicle for 'collective centering and collective sense making' within organisations, (Boyce, 1996) but management can exploit story telling in their interests. If we conceive 'the market for information' as a boundary network organisation then the concepts in this literature may be useful to interpret the role of the story in this context. Amber et al. (2001) provides an example of how marketing intangibles are being measured and disclosed in financial reports. The intangibles observed in the cases matched wider categories of knowledge intensive intangibles identified in the intellectual capital (IC) literature by writers such as Sveiby (1997). The case data also broadly reflected strategic analysis literature such as Porter's (1985) corporate value chain, as well as resource based strategies discussed by Barney (1991). Holland (2004a) provides a detailed discussion of the above literature and its relevance to disclosure content.

6. Corporate perceptions of disclosure interactions and market outcomes

Section 6 describes the dynamic (multi period) disclosure interactions between the case companies and information and stock markets, barriers to interaction, the outcomes or states arising in these markets, and the 'fragility' of these states relative to corporate and exogenous surprises. Diagram 2 (p.263) illustrates these interactions and outcomes.

6.1. Interactions, two-way learning, and market outcomes

A prime element of top management's role lay in regular private communication through one-to-one meetings and telephone conversations with major FMs and core analysts. These private disclosure interactions were driven by many factors including the financial reporting cycle, as well as ad hoc events (Holland, 1997). Growing shareholder wealth pressures created an important atmosphere for such private disclosure interactions.The case companies perceived that these interactions contributed to the creation of various understanding states (Y1), and confidence states (Y2) within individual key analysts and core FMs. The understanding state (Y1) was perceived to be about the story of top management quality and relative ranking or benchmarking of key company intangibles, and how these contributed to financial performance.

> **Case utility:** 'In these meetings the fund managers do not want to hear about last year's results. The current results will already have been fully analysed and the information transferred to fund managers. They do want to hear what is our strategy going forward. They want to hear how management see how the market or sector is developing. They want to understand how we are going to deal with the challenges facing the company. They want to know how we have performed against strategic promises made two years ago and one year ago. They want an update on delivery for these promises. If downside risks exist they want to know how we are going to deal with it. If upside opportunities exist they want to know how we are going to exploit these.'

This learning was perceived to play a role in boosting individual main analyst and core FM confidence states (Y2) in the company value creation story, in top management, as well as in the company disclosure about this story.

> **Case bank:** 'Fund managers and analysts make judgements as to which companies have the right combination of this strategic package of technology, brands, and management, and are much more likely to deliver these promises. They are confidence judgements. If a company promise is not delivered then the whole package is questioned and the price will drop and there can be a very sharp drop here because of the confidence factor which is supporting each one of these factors alone is also supporting the whole combination. If something threatens their confidence in our technology, or strategy, or quality of disclosure, it makes threats to their confidence in our management and in our brands.'

The case companies also observed how FMs and analysts made use of evidence to test and corroborate the components of the corporate value creation story, to check corporate promises and ask more questions of the company. This process (Y3) was the perceived means by which company information played a role in generating current FM and analyst understanding and confidence states, and in building a corporate history or track record of story, promises, action, and performance.

> **Branded goods company:** 'Our CCC acquisition is good evidence for them. It is evidence of consistency with our story about focusing on good quality leading brands. By the purchase of CCC they see some progress in this story and plan. When we deliver the synergies of integration of this acquisition and keep the CCC people then this is more evidence of how strong our story is and how we have implemented it by direct action. The more sceptical FMs build in these intangibles into the price. They are active learners and they test our story against our behaviour and performance. They will carefully look at evidence of growth both in our sales and in our margins and they will look at these quarterly and they will look to see if there is a trend. They talk to retailers and to media areas. Once they have got a picture together, they can get a relative fix on the significance of a particular intangible to our value creation story and to our competitor's story.'

The combination of FM and analyst states and process (Y1,Y2,Y3) was perceived as forming an informed context and process for FMs and analysts to interpret new events and information. They played a central role in FM and analyst valuations of companies and in their subsequent decision action. History or track record states were a critical point at which new meetings began, and a vital base from which case companies could explain a major change in the company story. The absence of a track record or history was recognised as a major barrier for privatised companies relatively new to the stock market. The history states were also seen as a main point at which the evidence sifting and analysis process began for FMs and analysts.

> **Utility company:** 'We have faced a huge re-education process with the analysts and FMs over the past ten years beginning with the privatisation and then the de-merger and then the negotiation of some of the costly contracts over the last couple of years. We have moved from a historic utility position to a more customer focus now. This story was not clear to us at the start. The story was really developed by continuous dialogue between us and the fund managers and analysts.'

Many FM and analyst barriers (Y4) to effective use of company information were also identified. For example, the companies observed considerable variety amongst FMs in their portfolio tasks. Problems of bias, conflicts of interest, and error were perceived amongst sections of the analyst and FM community. All of the above were perceived as factors that could adversely affect FMs and analysts' ability to process company supplied information and thus undermine effective understanding and confidence states and the quality of their decisions. These problems are discussed fully in Holland and Johanson (2003).

> **Oil company:** 'We find that some fund managers are very short term and often ignore complexity in the business. Their focus is more on the short term, not two or three years ahead. These 'fashion' fund managers often focus on a single individual like the chief executive. The analysts have an even shorter horizon. Of course, we as a company may have a ten to twenty year horizon for projects .You can compare this with the long run fund manager who learns about the qualities of the management team over time. They are not deceived by one top manager. They want to know what is the succession policy and whether there is real track record here and whether people are getting through on performance and whether we do what we say we are going to do.'

6.2. Consensus outcomes in the market for information

The case companies were aware that various FM and analyst consensus states were critical to the market for information. Learning over many periods was perceived at the level of (say 20 to 30) individual core FMs (with overall ownership control) and individual major (say the top 10 to 15 ranked) sell-side analysts. This was understood to create equivalent understanding and confidence consensus states (about a company) across this informed and influential group in the market for information. The case companies were particularly interested in the nature and degree of this consensus (and outliers) amongst the core FM and analyst group. This group was considered to be the main influence on wider information and stock market states and hence their private views could act as a rough proxy for the wider market expectations and consensus. For example, they were thought to be the primary contributors to market wide earnings and price expectations (for the company and sector). The **consensus *understanding*** states concerned a consensus about qualitative factors such as the current corporate value creation story, management succession, and likely strategic changes both at company and sector levels.

> **Case oil company:** 'In the meetings companies are repeatedly making promises to deliver good performance. ...Taking this process in the round you can see that all of these interactions over time, form a package of expectations and promises and measures about the future. It is in this package, between the company and its fund managers and the market at large, that we see that there is probably a price premium for brands, for technology, effectiveness, and quality of management.'

The **consensus *confidence*** states were concerned with wider market views on the (ranges of) likelihood of corporate success. These consensus confidence states involved (a range of) conventional numbers such as future earnings and price estimates. The forecast numbers were amenable to statistical analysis through the calculation of means, medians, and standard deviations, and these summary statistics were available from commercial services. A confidence consensus in strategy and value creation also existed in the form of the degree of perceived convergence, consistency, and common coherence of ideas and opinion amongst the core analysts and FMs, as well as their degree of agreement on the chances of success. Variation around this central tendency was manifest in the unique interpretations or critiques of the corporate value creation story by a small number of analysts with strong reputations. This variation reflected many of the FM and analyst information processing barriers (Y4).

> **Case insurance:** 'There are questions of confidence in the market about the more traditional intangibles like the underwriting skills in insurance. There are also many, many questions about the newer kind of intangibles being used in insurance such as brands and marketing and new distribution methods. These all affect how the market values the business and the confidence the market has in the top management and its strategy. The analysts and the major fund managers have to make a leap of faith here in terms of these connections. They are asking are we credible in what we say in terms of this value creation story. Do we have the ability to make it happen? Our main investors and the market are holding judgement as to how we are going to deliver here. There are many other market confidence issues here. The general insurance industry and the non-life insurance industry lost its reputation with the market. This is because of cavalier management which misused excess capital and if we sold a business now for £500 million the market would be desperate for us to hand it back to the fund managers.'

The case companies could interpret these (qualitative) consensus understanding and confidence states by a careful reading of the top 20 or so analysts' reports and through dialogue with the top FMs, analysts and traders after the earnings announcements. The companies directly asked traders, FMs and analyst how they valued the company, what they thought was in the company price, and tried to relate that to company supplied information. They tried to identify gaps and misunderstandings among their core FMs and analysts and deduce what information was contributing to the range of expectations, and what information was not in the price. Companies such as Mori conducted benchmarking surveys of FMs and analysts for a company's sector. This provided companies with some insights into a consensus on critical success factors and weaknesses. All of these sources could potentially be used to summarise a 'market story' of value creation and assess market confidence in this story and in estimated earnings and price. However, the case companies knew they were guessing about what FMs, analysts, and traders were guessing was in the share price.

6.3. Perceived 'fragility' of FM and analyst states

The FM and analyst understanding and confidence states were deemed very sensitive, or 'fragile' relative to new company circumstances (Y5) or new market conditions (Y6) especially when these interacted in a negative way with the barriers and problems (Y4). New company circumstance (Y5) included *inter alia*, surprise company events or unexpected performance relative to the story, information about a fundamental change in the value creation story, or news confirming how risky a company story was.

> **Telecommunication case:** 'The brokers' analysts' forecasts are very sensitive to under financial performance. There are very big terminal values in our discounted value. Everyone believes in Internet growth. The question is who is going to capture it and will it be profitable. The jury is out on that. The analysts and fund managers are grasping at new information to assess these terminal values. News, any news, seriously affects the share price here. These are very volatile share prices.'

New market conditions (Y6) included *inter alia*, a narrow focus on a current 'running' story relevant to a company, changing market and sector sentiment leading to changing valuation views and information needs, and sudden stock price (company and market) changes (independent of company disclosure or actions).

> **Branded goods case:** 'We have been a darling of our stock exchange sector because we have done so well in terms of increasing shareholder wealth. However there have been some major changes in sentiment in the stock market in the past two or three years. The new stock market has a stronger focus on top line growth or sales rather on bottom line or profits. The Internet stocks are very fashionable and really the issues have been who has got the sales and who gets the market share rather than whether any profits were emerging here. This fashion has affected us and we are placing much more emphasis on top line growth or sales than we did previous to 1997.'

Fragility also arose due to company side factors. This included a high exposure to uncertainty in the real businesses as companies changed their economic processes from highly tangible assets and processes to new knowledge intensive assets and less visible processes. If top management qualities or other observables had been used as a proxy for the more complete value creation story (because of complexity or invisibility) then unexpected top management problems could magnify the fragility effects on understanding and confidence, and lead to major price drops and high volatility. In other companies, fragility arose because they failed to deliver promises or had been opportunistic. Such fragility, was in turn expected to contribute to more fragile earnings estimates and valuations.

6.4. Summary of the theoretical frame and relevant literature

Section 6 has described disclosure interactions, barriers, outcomes in markets, and the 'fragility' of these outcomes. A brief view of the literature on investor psychology and on value relevance will be used to explore these case findings. The focus of company managers on how FMs and analysts acquired understanding and confidence states can be related to the emerging literature on cognitive psychology of investors (Hirshleifer, 2001, Statman, 1999). This deals with how investors make decisions, use heuristics, and the way they acquire, remember and process information, and how they use this to gauge the probability outcomes of their decisions. The case companies perceived cognitive limitations amongst fund managers and analyst and recognised that this led to the use of heuristics or of rules of thumb to simplify a complex world. For example, FM and analyst problems of processing company intangibles information were 'solved' by focusing on a narrow group of major intangibles and by benchmarking major intangibles. The literature also notes that the use of 'availability' heuristics (judgments on what is remembered rather than complete data) and 'representative' heuristics (probability judgments on recent outcomes rather than many historic outcomes) can also create processing problems. The limitations of observed heuristics were perceived as adding to FM and analyst barriers (Y4) and introducing biases to the processing of company supplied information. The case data also revealed how fragile these understanding and confidence states were perceived to be. The high sensitivity to changing company (Y5) and market (Y6) circumstances suggest that this reflects, in part, psychological evidence on additional market side factors such as individuals placing too much weight on the most recent data, being overconfident and over reacting, and naïvely extrapolating time series.

The grounded theory elements in this section have also provided insights into company understanding of the perceived usefulness of the information to markets. The case company observation that company managers, fund managers and analysts jointly used the story and various benchmark measures, indicated that these mechanisms did have the perceived means to communicate new information. The case companies also perceived that the market for information defined (company supplied) 'value relevant information' in a partial, changing, ex ante, transient, holistic, and negotiated sense. This was thought to generate value relevant knowledge in analysts and fund managers, as well as boosting their confidence states. These states were seen as 'lenses' or informed contexts through which new company supplied information and exogenous events were interpreted and deemed value relevant. The growing intensity of the shareholder wealth maximisation (SWM) atmosphere in the private interactions and the emphasis on SWM-oriented information was consistent with corporate finance theory. It suggested that much of this information was intended by all participants to be value relevant in the terms of improving recipient understanding and their ability to interpret future price-moving events. This appears to conflict with regulation on price sensitive information (PSI). However the case companies publicly announced PSI (Holland and Stoner, 1996). They avoided PSI release in private, and private disclosure was explicitly designed to avoid affecting the current price in a significant or material way. The companies kept to the PSI guidance but could still release information on the 'big picture' and could seek to improve fund manager and analyst understanding.

In the stock market, information use and usefulness were continuously observed, discussed, perceived, and deduced by the case companies. They closely observed the impact of private interactions and corporate voluntary public disclosure on publicly observable price, volatility, liquidity outcomes in the stock market. Cost of capital changes were assessed over longer periods. They inferred the quality of the market information set from an active dialogue with traders. This can be compared with literature concepts of 'value relevance'. For example, Market Based Accounting Research (MBAR) employs a precise, unchanging, definition of value relevance. This refers to information on observable historic events or specific disclosures which affects prices, or information has value relevance if the historic information based on perfect foresight has affected historic returns or prices (Schipper, 2001). The company focus on stock price behaviour and its response to voluntary disclosures is consistent with the concepts of value relevance employed MBAR. However companies did not employ the scientific rigour of MBAR, and were focused on continuing change in an interactive disclosure system rather than on a specific event or disclosure channel.

7. Corporate disclosure responses to perceived market outcomes

In Section 7, we explore how corporate learning and perceptions of market outcomes, reinforced by FMs during subsequent one-to-one meetings, fed back into corporate disclosure. This feedback influenced disclosure in the form of priors or learnt preferences for disclosure content, disclosure choice and behaviour, and disclosure structures and processes. The feedback also influenced disclosure adaptive responsiveness as a quality of the other priors. The case companies also built in dimensions of stability and persistence. These priors have been partially covered in previous sections and will be summarised here.

7.1. Disclosure content priors

In Section 5, we have seen how the companies developed content priors on how the story and benchmarks were important means to disclose information. The companies recognised that they needed a coherent story and needed to persist and 'live with their story' through positive and negative events over time. In addition, the growing shareholder wealth maximising (SWM) pressures in private meetings and in public discourse meant that the UK case companies learnt that corporate disclosure to markets had to be narrower, focused, bounded, and have a clear SWM aim. Ezzamel et al. (2002) revealed how intense these shareholder wealth pressures were in a US context, and how a CEO interpreted and transmitted these pressures internally through corporate strategy. The case companies also developed responsiveness priors on how to let the story content evolve in response to **changing** corporate processes, to changing views of senior FM and analysts, to listener competence and the complexity of their valuation models, and to changes in market sentiment. More specifically, the case companies learnt that the prevailing market concept of SWM oriented or value relevant information was transient and changed with changes in market structure, fashion, and sophistication. During the dot.com period of 1997–2000, the case companies argued that FMs and analysts only looked at stock market changes and portfolio actions by other FMs as their primary source of information and ignored much company fundamental or value creation information. During the dot.com period the case companies (all old economy) responded by developing internet strategies to match the prevailing fashion. In other periods before 1997 and after 2000, company value creation information was thought to be combined with market derived information to form the value relevant information set. In Section 6 we have also explored how the case companies experienced high fragility of understanding and confidence states. In the cases, the perceived and observable market consequences of fragility were more strongly linked to disclosure of information on a small number of 'runs' or connected negative events. This confirmed the significance of asymmetric payoff for disclosure behaviour in the market for information observed by Gibbins et al. (1990). A high negative payoff for disclosure behaviour was also connected to fragility based on the loss of confidence in disclosure proxies such as top management quality. The fragility and the asymmetric payoff encouraged case managers to continuously monitor understanding and confidence states, to be alert to changes, and to ensure a rapid and informed response. The information reserves played a main role in matching these contingencies.

7.2. Disclosure choice priors

Section 4 illustrated how the case companies developed priors or stable corporate preferences for secrecy over private disclosure, and for private disclosure over public choices. The priors also included the need to match disclosure benchmark norms and seek high rankings for corporate disclosure quality. These disclosure priors for choice relate to Gibbins et al.'s (p.130) concept of disclosure **predisposition**, or a 'stable preference for the way disclosure is managed'.

7.3. Disclosure behaviour priors

The case companies learnt that three processes prevented them from freely exercising their biases towards optimism and opportunism during the one-to-one private meetings. First, the case company core FMs had an opposite tendency to focus on downside risk and they were often faced by probing and informed FM questions. Second, each case company faced external benchmark norms for 'good' private disclosure. Third, the accumulated learning over many periods created an awareness in companies of the stock market penalties associated with opportunistic behaviour and its role in creating fragility. These were factors in making them, in part, overcome their preferences for an optimistic bias, and to control their tendencies for opportunism during private disclosure.

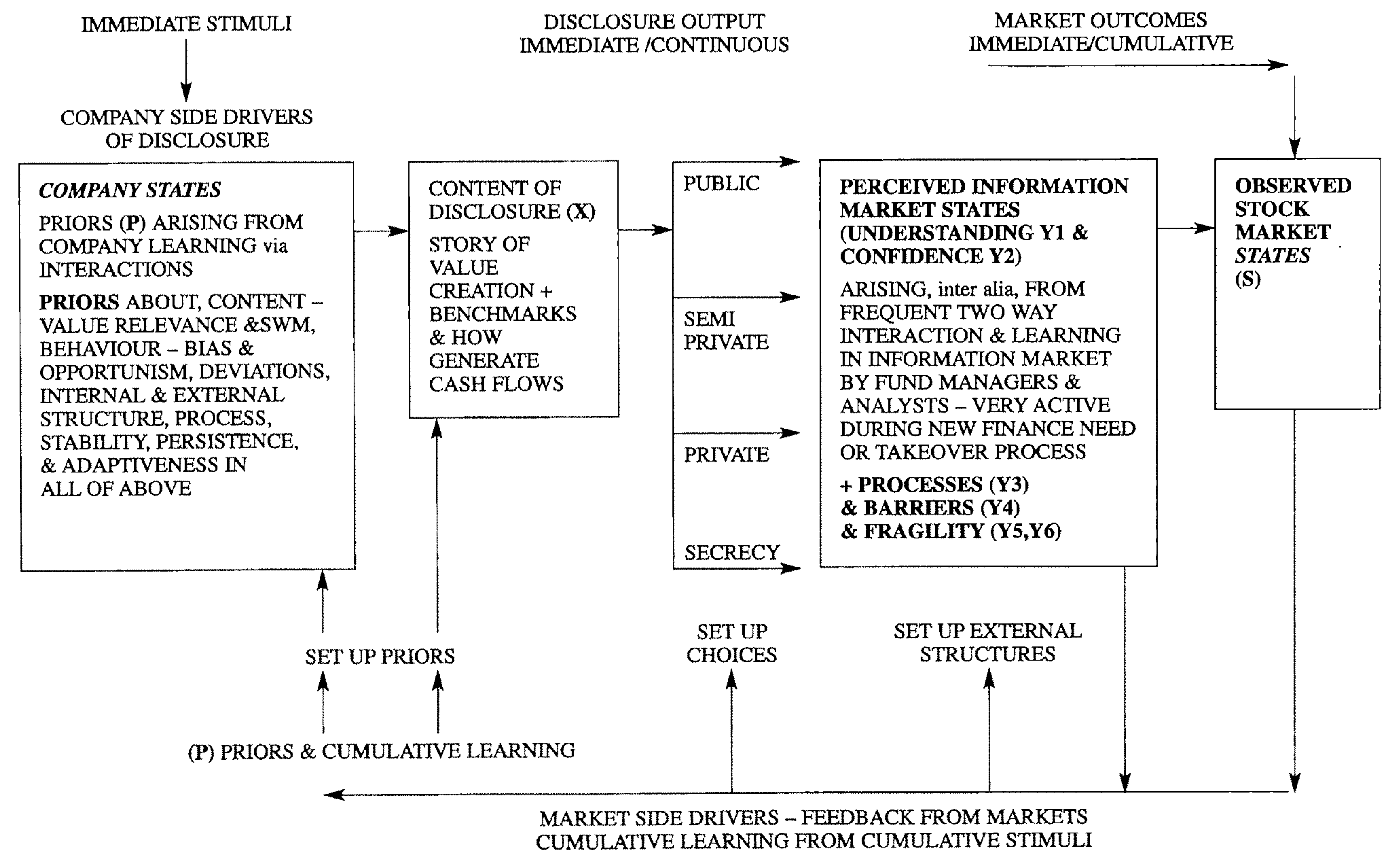
Two kinds of deviation from consensus mattered to the case companies. The first concerned a difference between a current market consensus and the current company view. The second concerned differences between the historic consensus and what actually happened. For example, in the first case, if a major information asymmetry was perceived between the current market earnings or story consensus relative to the company view then the companies had to release this publicly as price sensitive information (PSI). They could then use private one-to-one meetings and other private channels to freely discuss, in detail, the much less precise, much vaguer set of concepts surrounding the value creation story, and hence ensure that the core FMs, and analysts, fully understood the story. Some of the case companies sought to be more proactive in managing the consensus and deviations.

> **Telecommunication case:** 'Our IR Director can talk credibly with brokers' analysts about their models and the content of their models. Providing this kind of comfort and credibility is the heart of financial communications. This ensures that the brokers' analysts' models are realistic. By this we are trying to be prudent with them but are not too downbeat in terms of the realism in the models. We also prefer to surprise them on the upside not on the downside. Some people may take the view that the investor relations job is to create a rose tinted view of the world and we are the spin-doctor. The analysts come to some decision about the size of the market, our market share and growth and then do some estimate of our profit from that market share. There is enormous latitude to add in, say, a take-over premium which may add plus fifteen percent of the share price or you may decide to take away an execution risk which will reduce the share price by ten percent. As a result there is a very wide range of brokers' analysts' estimates of our price. There are some very big terminal values where most of the benefits are coming in the future four or five years down the road. Given our high FTSE 100 position it shows how significant this valuation is. That is why it is in our interests and the interests of FMs and analysts to support that value and to ensure that their valuation models are realistic.'

7.4. Priors for disclosure structures and processes

The need for increased organisation, responsiveness and sophistication in internal and external structures had been learnt by the case companies as they faced more sophisticated, global, and volatile markets and increasing SWM pressures from their core FMs. Tight control was exercised by small, closed, top management team with sole responsibility for financial market disclosure, consisting of the chairman, chief executive, finance director, and investor relations directors. These individuals received training and advice from consultants on how to manage their disclosure output and behaviour. Scripting and rehearsing one-to-one meetings were common practices. The companies developed a high readiness to make rapid press releases in response to changing market 'attention cycles' or when there was high market attention on a current company story. Holland (1997,

Diagram 2
Dynamic processes and interactions


IMMEDIATE STIMULI
COMPANY SIDE DRIVERS OF DISCLOSURE
DISCLOSURE OUTPUT IMMEDIATE /CONTINUOUS
MARKET OUTCOMES IMMEDIATE/CUMULATIVE
COMPANY STATES
PRIORS (P) ARISING FROM COMPANY LEARNING via INTERACTIONS
PRIORS ABOUT, CONTENT – VALUE RELEVANCE &SWM, BEHAVIOUR – BIAS & OPPORTUNISM, DEVIATIONS, INTERNAL & EXTERNAL STRUCTURE, PROCESS, STABILITY, PERSISTENCE, & ADAPTIVENESS IN ALL OF ABOVE
CONTENT OF DISCLOSURE (X)
STORY OF VALUE CREATION + BENCHMARKS & HOW GENERATE CASH FLOWS
PUBLIC
SEMI PRIVATE
PRIVATE
SECRECY
PERCEIVED INFORMATION MARKET STATES (UNDERSTANDING Y1 & CONFIDENCE Y2)
ARISING, inter alia, FROM FREQUENT TWO WAY INTERACTION & LEARNING IN INFORMATION MARKET BY FUND MANAGERS & ANALYSTS – VERY ACTIVE DURING NEW FINANCE NEED OR TAKEOVER PROCESS
+ PROCESSES (Y3) & BARRIERS (Y4) & FRAGILITY (Y5,Y6)
OBSERVED STOCK MARKET STATES (S)
SET UP PRIORS
SET UP CHOICES
SET UP EXTERNAL STRUCTURES
(P) PRIORS & CUMULATIVE LEARNING
MARKET SIDE DRIVERS – FEEDBACK FROM MARKETS CUMULATIVE LEARNING FROM CUMULATIVE STIMULI

1998), and this case work also revealed that companies have learnt to operate within a responsive external structure consisting of their core FMs and analysts, set within the larger market for information. The choice of the core market contact group as the only group allowed to speak to the closed corporate group was based on a cost benefit calculation concerning top management time and eventual stock price impact. Gibbins et al. (1990) identified passive ritualistic behavioural influences as an element of disclosure position. The reporting cycle and the stable links with core FMs and analysts provided the focus for regular, ritualised interactions in which the case companies sought to control content and access. However, increasing professionalism and control by FMs had disrupted their content rituals concerning the private meeting presentation style, questions, and subsequent debate.

7.5. Summary of the theoretical frame

This section has illustrated how corporate learning fed back into corporate disclosure and created a context or set of priors which influenced current and future disclosure. Relevant literature has also been used within the section to discuss such priors.

8. Discussion of the overall grounded theory of corporate disclosure

The overall grounded theory summarised in the paradigm model (Section 3) provides a development of the prior work by Marston (1996), Barker (1997), and Holland (1997, 1998) concerning private corporate disclosure. In Holland (1998) a corporate disclosure model included connected themes such as choice of disclosure channel, a private information agenda, constraints, and two-way exchanges and learning. The new grounded theory has extended this model in terms of the range of choices, the role of story and benchmarks, the range of intangibles involved, perceived market outcomes, and corporate disclosure learning and development of priors.

In Diagram 2 the full set of interactions and outcomes are illustrated. We can summarise key implicit equations in this diagram as follows:

- Understanding states (Y1), and confidence states (Y2) , Process (Y3) were functions, inter alia of [Story (X), Priors (P), Interactions, and Barriers (Y4)].
- Fragility of understanding and confidence states was a function, inter alia, of [company (Y5) and market (Y6) circumstances].
- Stock market states (S) were a function, inter alia, of [Y1, Y2, fragility, and story].
- Priors (P) were a function, *inter alia*, of company learning over time about all of the above.

As indicated in previous sections, this research also bears important similarities to seminal work by Gibbins et al. (1990). Gibbins et al. investigated disclosure processes in 20 Canadian firms, and employed a similar grounded theory approach to develop a vocabulary of constructs and variables to describe disclosure processes and to identify relations among these constructs and variables. Diagram 2 illustrates **the interactions, structures, and perceived market outcomes** in the grounded theory model and reveals the similarity with the model identified in Gibbins et al. (1990).

In both studies, *corporate learnt states contributed* to priors or disclosure preferences concerning content, behaviour, and structure. These priors have been recognised, in part, as being determined by previous interactive learning, feedback and stimuli from financial markets, thus revealing their joint input and output role in disclosure. Internal and external structures were major components. Stimuli existed in the form of immediate stimuli, and of cumulative stimuli which both contributed to corporate learning. The present study and Gibbins et al. (1990) placed similar emphasis on opportunism, policies, structures and processes and both studies demonstrated potential causal links between these components.

The research results begin to differ when we look at specific behaviour and structures set in quite different contexts. These UK differences included the high profile and significance of, the company value creation process; of intangibles; of public, private, and secrecy choices; of the 'story' and benchmarking; of the external structure in the market for information; and of the continuous nature of disclosure. This research noted the prominence of the perceived (market outcomes) states of understanding, confidence, and consensus about disclosure, of barriers and fragility. It also noted the significance of the priors in improving understanding and confidence states, reducing the effects of barriers, and developing a rapid response to perceived fragility. The differences between the studies may be attributed to the very different decision contexts (City of London) for the study participants, differences in the significance of intangibles in value creation, large UK company focus, and the influence of the 1997–2000 dot.com period. As a result, the Gibbins et al. (1990) model and the present study suggests that a common underlying model may exist for disclosure across different contexts. However, this research indicates that their framework is possibly an over-simplification, not covering the full interactions possible, and not recognising the joint issues of fragility and responsiveness.

9. Conclusions and further research

The paper has developed a grounded theory of corporate disclosure for large UK FTSE 100 companies set in the context of a major world financial centre. The major elements in the theory can be interpreted as tentative means for the companies and other information market participants to deal with the new enhanced information asymmetry and market valuation problems associated with intangibles during 1997–2003. The paper reveals how a grounded theory approach can develop new integrated insights into disclosure behaviour and how the resulting theory is closely connected to existing disclosure theory and literature. It also reveals how new theory and literature can be relevant to understanding disclosure

The grounded theory could be extended by going outside the FTSE 100 or FTSE250 company range, and outside the 'wholesale' market for information (large fund managers, top broker analysts), to a world where disclosure is less sophisticated and where the market for information provides fewer demand pressures. This could include medium-sized listed companies as well unlisted companies, and this may provide stronger similarities to the Gibbins et al. (1990) model. Finally, we can note that the grounded theory provides a key context for other disclosure research studies. It may provide a wider explanatory context for market-based accounting research studies. Event studies or studies of financial reporting may be placed within the context of continuous corporate disclosure. This may help identify other events and processes obscuring the information content of the chosen event or the informativeness of the reporting mechanism. New 'intangibles' events may also be identified which have information content. These could include observed changes in intangibles benchmarks such as management quality, or R&D effectiveness. Research is also required to unravel the interactions between financial reporting and the other, wider elements of the grounded disclosure model (Holland, 1998). Finally, the model captures information flows of relevance to many corporate finance decisions. Such a model may potentially be combined with an investment-financing cash flow model of the firm (Brealey and Myers, 2003, ch.1) to add a novel and dynamic information dimension to conventional corporate finance.

Appendix 1

Table 1
May 2000 FTSE250

Case	*Industry*	*Rank range*	*Length interview*	*Period interview*	*Position*
1	Pharmaceutical	1–10	2 hours	9/00	FD, IR
2	Chemicals	60–70	2	10/00	IR
3	Technology	80–90	2.5	10/00	Dir Comm
4	Bank	1–10	1.5	9/00	FD
5	Oil	1–10	2	9/00	FD
6	Consumer	80–90	2	9/00	Dir Comm
7	Transport	90–100	2	8/00	FD
8	Property	80–90	2	10/00	FD
9	Insurance	50–60	2	9/00	Dir Comm
10	Insurance	10–20	1.5	8/00	IR
11	Media	230–240	1.5	10/00	Dir Comm
12	Consumer	40–50	1.5	10/00	FD
13	Technology	20–30	1.5	10/00	IR
14	Retail	20–30	2	9/00	IR
15	Telecom	20–30	2	11/00	IR
16	Utility	40–50	1.5	10/00	IR
17	Transport	70–80	2	10/00	IR
18	Consumer	20–30	1.5	11/00	IR
19	Oil	1–10	1.5	9/00	IR
20	Tobacco	40–50	1.5	9/00	IR
21	Utility	40–50	1.5	8/00	FD
22	Utility	110–120	1.5	8/00	FD, IR
23	Hire	190–200	1.5	8/00	CHAIR
24	Bank	40–50	2	8/00	CHAIR,IR
25	Insurance	30–40	2	11/00	IR

Key: CHAIR – chairman, FD – finance director.
IR – various titles for senior investor relations director.
Dir Comm – various titles for senior financial communications director.

Appendix 2

The following disclosure questions, inter alia, were posed to the case companies:

- How do you disclose information about intangible assets and their risks to fund managers, analysts and the stock market? Via financial statements, announcements, internet, private meetings, other means?
- What are the problems in disclosing such information to analysts, fund managers, or through public channels?
- Will the recent changes to the price-sensitive information guidelines (UK, 1994) or the Fair Disclosure Rules (USA, 2001) impede communication of information on intangibles?
- What is the role of information acquired by direct observation? i.e. those intangibles directly observable (by analysts and FMs) when employed within the company or when employed in competition in real product markets?
- How do you make (and how can you make) choices about which qualitative information should be released via various channels such as financial statements, stock exchange announcements, or through private meetings?
- How does the combination of public and private disclosure produce more information for investors (institutional and others) and other users?
- How do you protect your knowledge about these intangible asset advantages?

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The accuracy of IPO earnings forecasts in Thailand and their relationships with stock market valuation

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Abstract—In order to help reduce information asymmetry between managers and prospective investors, IPO prospectuses in Thailand are required to publish managers' forecasts of the forthcoming year's earnings. This type of direct disclosure is especially important in a developing economy such as Thailand where financial intermediaries and information vendors are relatively sparse, and where investors are rarely professionals. Our results demonstrate that managers' earnings forecasts are much more accurate than extrapolations of historical earnings. We show that forecast accuracy is related to underpricing, and it has a directional, but not statistical, association with one-year stock returns and one-year wealth relatives.

1. Introduction

Buying stocks in an initial public offering (IPO)[1] is more risky than investing in already listed companies since information on IPOs is scarce (Firth, 1998). Information asymmetries between management and potential investors are major uncertainties facing investors when deciding whether or not to subscribe to new issues. In these situations, firms or issuers have to convey information that can be used to value their shares. In the US, IPO shares are sold to the underwriters and investment banks, which then distribute the stocks to favoured clients. The underwriters and investment banks have non-public information on the IPOs and they communicate this to their clients. The favoured clients include institutional investors and high net worth individuals; small investors rarely get a chance to participate in IPOs (Stoughton and Zechner, 1998). In these circumstances, public information is not so important for the favoured investors. However, these circumstances do not prevail in many countries, where, instead, IPOs are marketed directly to the general public. For example, Thailand, the focus of our study, does not allow the issuer to discriminate against subscribers in the primary market and most subscribers are small individual investors (Lonkani, 2000). Large institutional investors (e.g. unit trusts, pension funds, insurance funds) are rare in Thailand and in order to get widespread ownership and active trading, IPOs are marketed to the public.

Individual investors have a relatively low capability to acquire and evaluate information on IPO stocks relative to institutional investors. Furthermore, they have to rely on public information since they cannot make contact with issuers directly. In this market, the information contained in the prospectus typically represents a substantial proportion of the publicly available knowledge about the firm. Thus an earnings forecast contained in the prospectus of an IPO is potentially more important to investors in countries where IPOs are sold to the general public. Empirical evidence (Firth, 1998; Jog and McConomy, 2003) suggests that investors do indeed rely on earnings forecasts when subscribing to new issues and they use this information in pricing shares on the first day of listing. We argue that in Thailand the earnings forecast published in an offering prospectus is very important information. This follows as investors are primarily individuals, and there is relatively little published corporate information and relatively few information vendors to provide ad-

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[1] An initial public offering is the means by which a firm first obtains a listing. Shares are sold to investors and the proceeds are invested by the firm. Sometimes a listing is obtained by an entrepreneur selling her or his shares to the public and the firm issues no new shares and therefore receives no proceeds. One concern of the stock exchange is that there must be a sufficiently large free float of shares so that there will be active trading.

vice on future earnings and investment values. The role of earnings forecasts in signalling the market value of IPOs and in explaining initial and longer-term stock returns has received very little attention in the accounting and finance literature. This may be due, in part, to the virtual absence of published earnings forecasts in American IPO prospectuses. This absence of earnings forecasts is due to a concern about legal suits if the forecasts prove to be inaccurate (Firth, 1998).[2] The situation is different in the Thai stock market where forecast information about issuing firms' performances is a mandated disclosure in an offering prospectus. The Securities and Exchange Commission (SEC) in Thailand requires an IPO's prospectus to disclose a forecast of the firm's future performance and to publish the key financial information for the next period. This information includes a forecast of the future earnings and the dividend payout ratio.

An obvious concern about the forecasts of a firm's future earnings is their accuracy and bias. To date, however, the accuracy of earnings forecasts published in offering prospectuses in Thailand has not been studied. Therefore, the first objective of this study is to examine the accuracy of earnings forecasts published in IPO prospectuses in Thailand. The second objective of the paper is to investigate the relationship between the earnings forecast accuracy and stock returns that occur in the initial trading period of IPOs. The third and final objective is to examine whether there is a relationship between forecast accuracy and the aftermarket performance of IPOs. Such analyses can reveal whether earnings forecasts are reliable enough to infer the value of the new issues. Our results can help investors make better use of the information appearing in IPO prospectuses. Moreover, the earnings forecast accuracy can be used to help explain the abnormal returns that are associated with IPO stocks.

Our research extends the literature by undertaking a comprehensive investigation of IPO earnings forecasts and how they relate to stock valuation. The focus on Thailand is timely as it is one of the fastest growing economies, and one that is open for international investment. The research has implications for practitioners and policy makers. For investors and financial analysts, the offering prospectus is an important source of information for making decisions as regards investing in IPOs. Our research will reveal whether the information contained in offering prospectuses – in particular, earnings forecast information – is valuable. Policy makers can use our results as a benchmark for determining whether or not the forecast information is reliable and what kind of biases are present. If forecasts are deemed unreliable then regulators may need to rethink their position on requiring forecasts. Clearly, erroneous forecasts can undermine the very workings of the IPO market. Regulators may need to impose penalties and sanctions on IPO firms and their advisers if there is evidence of widespread bias in making earnings forecasts.[3]

Previous studies on the accuracy of earnings forecasts appearing in IPO prospectuses have primarily used data from British Commonwealth countries or ex-British colonies. Examples include Australia, Britain, Hong Kong, Malaysia, New Zealand, and Singapore. These countries and regions have similar securities laws and institutional frameworks. In contrast, Thailand does not have a British heritage and so it is interesting to explore the accuracy and role of earnings forecasts in this different environment. Businesses in Thailand are often controlled by tightly-knit families and they are generally loath to divulge information to the outside world. In order to sell shares in an IPO these firms have to become more transparent to the outside world and earnings forecasts are one way of reducing information asymmetry between the controlling shareholder and potential investors.

The remainder of the paper is structured as follows. Section 2 discusses the history of IPOs and the listing procedures of new stocks on the Stock Exchange of Thailand. Section 3 briefly reviews prior research studies that cover both domestic and international evidence. Section 4 describes the data and methodology. Section 5 presents and discusses the statistical results, and Section 6 concludes.

2. IPOs in Thailand

The Stock Exchange of Thailand (SET) was set up as a consequence of Thailand's National Economic and Social Development (NESD) Plan in 1961. The plan defined the country's direction and growth objectives. As a consequence of rapid economic growth, the Second Plan (1967–71) incorporated planning for a new capital securities market. The Third NESD Plan (1972–76) gave rise to the SET Act of May 1974, bringing into being the Securities Exchange of Thailand, as it was first named. Securities trading commenced on 30 April, 1975. On 1 January, 1991, the bourse's official name was changed to the Stock Exchange of Thailand.

Like other South East Asian countries and regions (e.g. Hong Kong, Malaysia, and Singapore), companies in Thailand are often controlled by a single shareholder and her or his family. These individuals and their families often borrow substantial sums from banks to finance their other investments. They use their shares in the listed firm as collateral for the bank loans and so they have an incentive for the firm's share price to be high even though they do not want to sell their controlling share stake. Obtaining a market value for their business is one reason why individuals choose to list their firms.

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[2] The American securities watchdog, the SEC, allows IPO firms to issue earnings forecasts but these are rarely observed in practice because of concerns about litigation. This is despite forecasts being 'protected' by the safe habour provisions of the SEC laws.

[3] To date there are no sanctions for missing IPO profit forecasts although there are penalties for wilful misrepresentation.

Since the SET was first established, a large number of firms have utilized this market as a major source of funding. The level of IPO activity can be conveniently divided into three periods that correlate with the economic conditions in Thailand. In the first period, from 1975 to 1986, there were few IPOs listed on the market. From 1987 to 1996, Thailand enjoyed rapid economic growth and many firms used the stock market as a major source for external funding. The third period is called the 'crisis' and 'after crisis' period (from 1997 to present). This period began with the Thailand and Asian financial crisis that started in July 1997. The effects of the crisis and its aftermath still linger today and, as a result, the number of IPOs is well below the heyday of the late 1980s and early and mid 1990s. The first period has 20 IPOs with an average of 2.2 IPOs per year. The second period has 317 issuing firms and an average of 31.7 IPOs per year. During 1997–2000, there were only eight IPOs in the market or an average of only two IPOs per year.

Prior to 1992, the Ministry of Finance and the Bank of Thailand (the de facto central bank) issued directives covering the new issue of shares. From 1992, the Securities and Exchange Commission (SEC) of Thailand became the main regulator of IPOs. The SEC was set up to enforce the provisions of the Securities and Exchange Act (SEA) of 1992. The SEA is a comprehensive legislative framework regulating all vital elements of a modern capital market, such as disclosure, investor protection, fund management, takeovers, and the establishment of securities firms. The SEA also provides a clear separation between primary and secondary markets and this helps to facilitate their successful development. The primary and the secondary market are both regulated by the SEC. In the primary market, the SEC oversees and regulates companies that wish to issue new securities. Companies that carry out an initial public offering or issue additional securities to the public must first apply for SEC approval and comply with its listing requirements. The SEC is then required to carefully review the financial status and operations of the company before allowing the firm to issue securities to the public. The SEA sets out detailed requirements and procedures that IPOs must follow. From 1992 onwards, listing firms had to publish detailed pro forma financial statements for the next fiscal year in the prospectus. These statements include forecasts of earnings before tax and earnings after tax. Prior to 1992 earnings forecasts were voluntary although in 1991 (the first year of our study) most IPO firms gave an earnings forecast. The prospectus has to describe the assumptions behind the forecasts. The SEC requires listing firms to use an auditor from an approved list; there are 21 audit firms on the list and these include international auditors (including the then Big 5) and local auditors.

In the process of selling the new issues, the financial adviser often sets up an underwriting syndicate to reduce the marketing risk. When an application to make an IPO is approved by the SEC, committees from the SEC, together with the offering participants, decide on a subscription date and the financial adviser prepares the offering prospectus. In Thailand, the underwriting contracts are entirely of the firm commitment type. When the contract is signed, participants begin their marketing process and distribute the details of the new issue including the fixed offer price via the offering prospectus and other media. The whole listing process has to be completed within 240 days (from the submission of an application form to the listing department of the SET to the end of the selling process).

The prospectus publishes actual earnings for the three years prior to the IPO, along with Balance Sheet information. The earnings forecast and issue price are prominently featured and appear at the front of the prospectus. An auditor reviews the financial information in the prospectus. The auditor also checks the compilation of the earnings forecast.[4]

3. Prior research

A company's managers publish financial forecasts so that investors may more accurately price the shares of the company. In some cases, managers may try to deceive investors with deliberately inflated earnings forecasts but this is relatively rare because the deception will work only once and because managers will open themselves up to lawsuits from investors (especially in the US). More often, managers release earnings forecasts because they believe the analysts' forecasts are significantly wrong (Hassell and Jennings, 1986) or else they believe the stock price does not represent the true value of the firm. There is a large body of research on managements' dissemination of earnings forecasts although most of it comes from the US. Examples of this literature include Hassell and Jennings (1986), McNichols (1989), Lev and Penman (1990), Baginski et al. (1993), and Pownall et al. (1993). These studies find that managements' earnings forecasts are informative and stock prices adjust to reflect the forecasts. Lev and Penman (1990) find that managers are more likely to issue forecasts when the forecast exceeds the market's expectations. The above studies examine voluntary earnings forecasts made by already-listed firms. Another strand of research investigates earnings forecasts made by IPO firms. This literature typically uses data from British Commonwealth countries as these have a tradition of providing earnings forecasts in IPO prospectuses, and in some cases the forecasts are mandatory. This strand of research is pertinent to our study. As described earlier, earnings forecasts are a potentially important piece of information for investors. Firth (1998) explores the relationship between earnings forecasts and firm valuation and finds that they are a major signal of IPO value and that they are more important than other signalling tools such as the retained share ownership of the entrepreneurs. Kim and Ritter (1999) also find that earnings forecasts do a much better job in signalling IPO value than historical earnings. Clearly, the relationship between an earnings forecast and firm value depends on whether investors believe the forecast is accurate.

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[4] The auditor does not express an opinion on the assumptions that underlie the profit forecast.

The issue of the accuracy of an earnings forecast in the IPO prospectus has been explored at length by many researchers. Research in Australia (Lee et al., 1993), Canada (Pedwell et al., 1994; McConomy, 1998) and New Zealand (Firth and Smith, 1992) reveal large forecast errors. Studies on Asian IPO markets have found relatively small forecast errors. Chan et al. (1996) and Jaggi (1997) report mean absolute forecast errors of 18% and 12.9% for listings in Hong Kong, respectively. Mixed results are reported in Malaysia. Mohamad et al. (1994) find low to moderate forecast errors, while later studies by Jelic et al. (1998, 2001) find somewhat larger errors.

Kim et al. (1995) investigate the role of information disclosed through the prospectus in the new issue market in Korea. The evidence indicates that the market price is significantly affected by financial variables, such as earnings per share, offer size, industry-wide prospects, and offer type. Firth and Smith (1992) examine the accuracy of earnings forecasts contained in prospectuses of IPOs on the New Zealand Stock Exchange. In their paper, accuracy is measured by forecast errors, absolute forecast errors, and squared forecast errors. They find that the level of forecast accuracy is poor when compared to studies conducted in the UK (Dev and Webb, 1972; Keasey and McGuinness, 1991). They hypothesise that forecast accuracy is related to the initial returns of IPO stocks. However, the empirical results provide no support for this hypothesis. Firth et al. (1995) find comparatively high earnings forecast accuracy for listings in Singapore. Firth (1998) further analyses the role of earnings forecasts for 116 IPOs in Singapore during the period 1977 to 1992. His results reveal that there is a strong positive relationship between forecasts and market valuations. Furthermore, the earnings forecast is a more important signal of firm value than retained ownership. Results from analyses of stock returns in the aftermarket indicate that forecast errors are a major explanatory variable. Jelic et al. (1998) find that managers under-forecast earnings in a sample of 122 Malaysian IPOs in the period 1984 to 1995. Malaysia is a country where IPO earnings forecasts are mandated and managers are conservative in their forecasts. Chen and Firth (1999) investigate the accuracy of earnings forecasts and their relationship with the stock returns of Chinese IPOs. They examine all IPOs made on the Shanghai Securities Exchange and the Shenzhen Stock Exchange from 1991 to 1996. The results show that earnings forecasts are moderately accurate and they are better than time series extrapolations of historical earnings. Their paper also shows that earnings forecasts are related to company valuations.

Cheng and Firth (2000) analyse the bias and rationality of earnings forecasts published in offering prospectuses in the Hong Kong stock market. Their results indicate that the magnitude of the forecast errors and the magnitude of the absolute forecast errors are much lower than those reported in developed countries such as Australia, Britain, Canada, and New Zealand. Firth (1997) argues that earnings forecasts may help explain the magnitude of the initial returns on the first day of trading in the IPO. He posits that investors multiply the earnings forecast by an 'appropriate' PE when pricing new issue stocks. In particular, he uses the ratio of the PE multiple of a matched firm that is already listed in the market and the PE multiple of the IPO firm as a signal of, and explanation for, underpricing. Firth (1997) hypothesised that the relative PE ratio is positively correlated with the initial return, and his empirical results are consistent with this prediction. Furthermore, he concludes that investors are able to anticipate some of the overprediction or underprediction in IPO earnings forecasts since he found a positive and significant relationship between initial returns and signed earnings forecast errors. In related research, Clarkson et al. (1992) conclude that earnings forecasts voluntarily published in Canadian IPO prospectuses are valuation relevant and the market is able to correct for earnings forecast errors. A later Canadian study by McConomy (1998) found that IPO earnings forecasts that were audited had less positive bias but were no more accurate than forecasts that were not audited. Keasey and McGuinness (1991) also report a positive relationship between conservative earnings forecasts and initial stock returns for IPOs on Britain's unlisted securities market. Jelic et al. (2001) find that conservative earnings forecasts are related to positive stock returns in the twelve months after the new IPO. Their study is interesting as it documents positive stock returns in the three years after the IPO; the evidence in Malaysia runs counter to the negative IPO stock returns reported in most countries (Loughran et al., 1994).

Teoh et al. (1998) claim that IPO firms in the US manage their earnings prior to listing in order to obtain a higher issue price. However, the models used to capture earnings management are controversial and there is now considerable doubt that they provide useful estimates. Given the lack of an adequate model to isolate earnings management, we do not attempt to measure it in this study.

IPOs in the Thai stock market also exhibit anomalies similar to those found in other countries (Wethyavivorn and Koo-Smith, 1991; Suewattana, 1993, Sribooncharoen, 1997; Kritsernvong, 1998; Lonkani, 2000). Results from these studies indicate that, in the Thai market, the first-day trading prices of IPOs are greater than their offering prices but prices substantially decline in the weeks and years after listing. However, the relationship between pricing and the accuracy of profit forecasts in Thailand has not yet been examined. Given the potential importance of earnings forecasts to help value IPOs it is vital that the accuracy of the forecasts be investigated. Our study sets out to do just this.

4. Data and methodology

The principal source of the data is the I-SIM database, which is the official database provided by Stock Exchange of Thailand (SET). The data include price and return information, the offering price, size, age, and other listing information about new issue firms. IPO earnings forecasts are not available in this database and so we collect them manually from the offering prospectuses in the SET's main library. In this study, all offerings having relevant information during the period of 1991 to 1996 are examined. We choose this period because it has substantial IPO activity (see Table 1). Although the SEC began to enforce the publication of forecast financial information from 1992, many new issue firms published forecast information before 1992. Thus, the data used for this study begin in 1991. Since the Asian economic crisis began in 1997, we ignore the eight issues after this date. According to I-SIM, there were 254 new issues between 1991 and 1996. However, for some IPOs, there is not enough information available to analyse the returns in the primary market or in the secondary market. After excluding IPOs that had incomplete information, we are left with a total of 175 firms in our sample. The distribution by year of offering is shown in panel A, Table 1; the number of offerings was highest in 1991 and lowest in 1995. The average market sizes, including maximum and minimum market capitalisation, are also shown in panel A. Market size is measured in terms of number of shares multiplied by the issue price. On average, our sample of IPOs has a market capitalisation of 8778.8m baht at the offering prices. The top five issues by size are Jusmine International Public Company (JUSMIN), Telecom Asia Corporation (TA), Thai Airways International (THAI), KrungThai Thanakit Finance (KTT), and Sri Thai Superware Public Company (SITHAI). A breakdown of IPOs by industry is shown in Panel B of Table 1. The industry sectors are based on the SET classification. Most industry sectors are represented.

4.1. Forecast error metrics

The procedures for measuring forecast errors are taken from the literature (see Cheng and Firth, 2000). We calculate the signed forecast error as follows:

$$FE = (AP - FP)/|FP| \tag{1}$$

where

FE = forecast error; AP = actual earnings;
and FP = forecast earnings.

We also compute forecast error using the actual earnings as the denominator. The results are similar despite there being more extreme value observations. The extreme observations arise because in a few cases the actual earnings are close to zero. This problem is less acute when forecast earnings are used in the denominator. IPO prospectuses report earnings forecasts before tax and after tax (two numbers are given) and they are point forecasts (i.e. not a range). The results section reports forecast errors based on earnings after tax. However, when we use earnings before tax (forecast and actual) the results are similar. In some cases, firms had extraordinary items (EI) in the profit and loss account and so in supplementary analyses we omit the EI in the measure of actual earnings. This alternative does not change the conclusions of our study. No firms include a forecast of EI in their prospectuses.

The second profit forecast error is given by the absolute forecast error (AFE):

$$AFE = |FE| \tag{2}$$

The FE metric indicates the direction of bias of the forecast error while the AFE indicates the overall level of accuracy. A positive mean value for the FE implies a pessimistic bias where forecast earnings are less than the actual earnings. Conversely, a negative mean value for the FE indicates an op-

Table 1

Panel A. Sample distribution of IPOs by year of offering

Issue year	*Number*	*Mean Mcap (m. baht)*	*Minimum of Mcap(m. baht)*	*Maximum of Mcap(m. baht)*
1991	47	6033.81	226.01	55,714.29
1992	29	9715.46	375.00	84,000.00
1993	35	7786.85	245.00	122,265.00
1994	34	11439.94	420.00	154,415.49
1995	14	14397.77	770.00	70,003.44
1996	16	6625.61	280.00	28,400.00
1991–1996	175	8778.87	226.01	154,415.09

The Table shows the market size of IPOs in the sample and the distribution by year of offering. Size of IPOs is presented as Mcap which is the offering price multiplied by number of new shares issued. The unit is million baht.

Panel B. Sample distribution of IPOs by industry sector

Sector number	*Industry name*	*Number of IPOs in the sample*	*Number of companies listed*
1	Agribusiness	13	25
2	Banking	0	15
3	Building and Furnishing Materials	7	25
4	Chemicals and Plastics	4	13
5	Commerce	1	13
6	Communication	6	10
7	Electrical Products and Computer	4	11
8	Electronic Components	4	10
9	Energy	3	10
10	Entertainment and Recreation	3	7
11	Finance and Securities	20	53
12	Foods and Beverages	9	25
13	Health Care Services	9	11
14	Hotels and Travel Services	1	12
15	Household Goods	6	8
16	Insurance	7	22
17	Companies under Rehabilitation	28	71
18	Jewelry and Ornaments	1	3
19	Machinery and Equipment	4	5
20	Mining	0	1
21	Packaging	5	16
22	Pharmaceutical Products and Cosmetics	0	2
23	Printing and Publishing	4	9
24	Professional Services	1	2
25	Property Development	18	30
26	Pulp and Paper	2	6
27	Textiles, Clothing and Footwear	4	27
28	Transportation	4	8
29	Vehicles and Parts	4	9
30	Warehouse and Silo	0	4
31	Others	3	5
	Total	175	468

Note: Number of companies listed is the average number of listed firms in each industry (average over 1991–1996).

timistic bias where forecast earnings are higher than the actual earnings.

The absolute forecast errors (AFE) are compared against the errors obtained from using simple statistical time series extrapolations of historical earnings. A prospectus is required to disclose earnings for the three years prior to the offering, and we use these data to develop predictions of future earnings. Two time series models are examined; they are the random (RW) model, in which the forecast earnings (RWF) is the same as the latest earnings before listing (APt–1), and the growth (G) model, in which the forecast earnings (GF) is APt–1 multiplied by one plus the annual compound growth rate of earnings over the three years prior to listing (i.e. the square root of APt–1/APt–3, where APt–1 is the earnings in year t–1 and APt–3 is the earnings in year t-3). The absolute errors from these statistical models, AFE (RW) and AFE(G), are calculated as follows:

$$AFE(RW) = |(AP - RWF)/RWF| \quad (3)$$

$$AFE(G) = |(AP - GF)/GF| \quad (4)$$

To test whether managements' forecasts of earnings are better than the statistical models, we calculate DIFF(RW) which is the difference between AFE(RW) and AFE. DIFF(G) is the difference between AFE(G) and AFE. Our hypothesis is that earnings forecasts obtained from prospectuses are more accurate than the estimates from naïve statistical models. The hypotheses in alternative form can be written as:

H1: DIFF(RW) = AFE(RW) – AFE > 0

H2: DIFF(G) = AFE(G) – AFE > 0

Another approach to comparing the value of IPO earnings forecasts with forecasts from simple naïve models is to employ the superiority measure as used by Brown et al. (1987). The models are:

$$SUP(RW) = \log[([AP_t - AP_{t-1}]/[AP_t - FP_t])^2] \quad (5)$$

$$SUP(G) = \log[([AP_t - AP_{t-1} \times G]/[AP_t - FP_t])^2] \quad (6)$$

SUP(RW) and SUP(G) measure the superiority of IPO earnings forecasts over the random walk model and the growth model, respectively. G is the annual growth in earnings calculated over the period t-3 to t-1. It is the square root of the earnings in period t-1 divided by earnings in period t-3. The hypotheses in alternative form are:

H3: SUP(RW) > 0

H4: SUP(G) > 0

A third approach to measuring accuracy, and one that captures the bias, is the methodology of De Bondt and Thaler (1990) and Capstaff et al. (1995). Following their methodology, the actual changes in earnings are compared to forecast changes in earnings. This is done via the following regression model:

$$(AP_t - AP_{t-1})/AP_{t-1} = \alpha + \beta(FP_t - AP_{t-1})/AP_{t-1} \quad (7)$$

where the variables are as described earlier, and α and β are estimated by regression analysis. The null hypotheses we test imply $\alpha = 0$ and $\beta = 1$. If $\alpha<0$, we interpret an earnings forecast as having an optimistic bias (predicted earnings exceed actual earnings). Conversely, $\alpha>0$ is interpreted as having a pessimistic bias. $\beta<1$ is interpreted as an overreaction to available information (e.g. AP_{t-1}) and $\beta>1$ is interpreted as an underreaction to available information (Capstaff et al., 1995). An alternative model is to multiply AP_{t-1} times one plus the compound growth rate in earnings over the three previous years (G). Our hypothesis in alternative form is:

H5: $\alpha = 0$ and $\beta = 1$

4.2. Cross-sectional explanations for the forecast error

We examine factors that may help explain the magnitude of forecast errors. In our tests, we employ cross-sectional regression models where the absolute forecast error enters as the dependent variable. Explanatory variables are composed of six variables: the log of the market capitalisation of the IPO firm (SIZE), the log of the age of the IPO firm (AGE), the coefficient of variation for the three-years of earnings of the IPO before its listing date (VARIAT), the leverage ratio (LEVER), the log of the days in the forecasting period (LENGTH) (which is the difference between the prospectus date and fiscal year end), and a market index control variable (MKT). The regression model is:

$$AFE = \alpha_0 + \alpha_1 SIZE + \alpha_2 AGE + \alpha_3 VARIAT + \alpha_4 LEVER + \alpha_5 LENGTH + \alpha_6 MKT \quad (8)$$

where

AFE = is the absolute forecast error as measured in equation 2;
SIZE = is the log of the market capitalisation of the IPO;
AGE = is the log of the number of years since the IPO firm was established;
VARIAT = is the coefficient of variation for the last three-years of earnings of the IPO firm before listing;
LEVER = is the total debt divided by total assets of the IPO firm;
LENGTH = is the log of the number of days between the prospectus date and the

fiscal year end; and

MKT = is the return on the stock market in the month preceding the issue date.

The rationales for including these factors are based on previous theory-based and empirical-based research, outlined as follows. SIZE is a proxy for the capability of firms to forecast earnings with more accuracy (Dev and Webb, 1972). Large firms are believed to have more resources to devote to making forecasts. Therefore, we expect a negative relationship between SIZE and AFE. Similarly, older firms should have more experience in making profit forecasts and are expected to forecast more accurately than younger firms (Jelic et al., 1998). We therefore expect AGE to be negatively correlated with AFE. VARIAT represents the fluctuation in earnings before listing. This variable should be positively correlated with AFE as it is more difficult to forecast earnings for IPO firms that have a greater variability in historical earnings. LEVER is another measure of the risk of a company and high-risk firms are expected to have high AFE (Eddy and Seifert, 1992). LENGTH is predicted to be positively correlated with the forecast error based on the argument that the longer the horizon time, the more difficult it is to forecast accurately. Finally, market return (MKT) enters the model as a control variable. Previous research conjectures that there is a higher probability of error in forecasting when the market is rapidly changing (Cheng and Firth, 2000). If the market index changes greatly then this may reflect conditions that are difficult to predict. We define MKT as the proportionate change in the market index in the month prior to the IPO.

Other variables have been used to explain forecast errors in previous studies in other countries. Jelic et al. (1998) tested retained ownership as an explanatory variable although they found it was not significant. We did not include retained ownership as is it does not have much variability in Thailand. Many IPOs sell the minimum number of shares (20% of total shares) with the remaining shares (80%) held by the original owner. Jelic et al. (1998) also tested for a Big 6 effect but found it was not significant in explaining forecast errors (similar evidence was reported by Mohamad et al., 1994; and Firth and Smith, 1992). We find that more than 90% of our IPOs use Big 5 auditors and so there is not much variability in the type of audit firm. In light of these findings we do not include an auditor variable in our model.

4.3. Initial returns and aftermarket performance measurement

We use regression models to examine whether forecast errors are associated with short- and long-term stock returns. The initial return (IR) is measured as the difference between the first-day trading price (FT) of the IPO stock and the offering price, divided by the offering price (OP), or

$$IR = [(FT - OP)/ OP)]\times 100 \qquad (9)$$

Measuring long-run aftermarket performance is problematic because of a variety of biases including survivorship, rebalancing, skewness, cross-sectional dependence, and poor models of asset pricing (Lyon et al., 1999). As no consensus has emerged on which method should be used to calculate long-run returns, we use several metrics to capture aftermarket performance. These one-year returns are used as the dependent variable in our regression model described in Section 4.5. The one-year performance measures we use are monthly market adjusted returns, monthly comparison firm adjusted returns, and annual buy and hold wealth relatives. Details of these methods follow.

The aftermarket performance of IPOs is first measured using the monthly benchmark-adjusted returns, as in Ritter (1991). The monthly benchmark-adjusted return is defined as the monthly raw return on a stock minus the monthly benchmark return for the corresponding period. We calculate the returns for each IPO for 12 consecutive months. Month, in this case, is defined as a successive 21-trading-day period relative to the IPO date. Month 0 is defined as the initial return period, Month 1 consists of event days 2–22; Month 2 consists of event days 23–43, and so on. The benchmark used is the SET index. The benchmark adjusted return for stock i in event month t is defined as:

$$ar_{it} = r_{it} - r_{mt} \qquad (10)$$

The average benchmark-adjusted return on a portfolio of n stocks for event month t is the equally weighted arithmetic average of the benchmark-adjusted returns:

$$AR_t = \frac{1}{n}\sum_{i=1}^{n} ar_{it} \qquad (11)$$

The cumulative benchmark-adjusted aftermarket performance from event month q to event month s is the summation of the average benchmark-adjusted returns:

$$CAR_{q,s} = \sum_{t=q}^{s} AR_t \qquad (12)$$

Recently, researchers have argued that using market returns as a benchmark to calculate abnormal stock returns is too simplistic. Instead, multi-factor models (e.g. the Fama-French three-factor model) and industry- and size-matched comparison firms have been advocated. The work of Fama and French (1992) and Fama (1998) exemplify this literature. These and other researchers have illustrated their recommended procedures using data from the US. We therefore repeat our stock return calculations using an industry- and size-matched comparison firm approach where the stock returns of comparison firms are used instead of the SET index in equation (10). For each IPO firm we select a listed comparison firm. The comparison firm is in the same industry and is closest in size (market capitalisation). Additional comparison firm criteria are that the comparison firm had been listed for at least three years (and so it was not an IPO or a recent IPO) and that the stock is actively traded so that stock returns can be calculated. The latter criterion is quite restrictive as the size-matched requirement means comparison firms are quite small and thus their stocks are relatively illiquid. The small number of listed firms in Thailand means the comparison firm approach lacks the precision observed in the US. A further matching criterion based on the market-to-book ratio is also attempted. Unfortunately the matches are poor, and so we drop this criterion.

Lyon et al. (1999) argue that buy and hold performance measures avoid some of the problems inherent in cumulating abnormal returns. We therefore measure one-year performance using buy and hold wealth relatives. Here, we calculate the returns from a buy and hold strategy, where the IPO stock is purchased at the end of the first day's trading and held for a period of one year (no IPOs were de-listed in the first year). The buy and hold return is then compared to the buy and hold returns of the matched firms. The wealth relative is calculated as:

$$\text{WR} = (1 + \text{annual buy and hold returns on IPOs})/(1 + \text{annual buy and hold returns on the matched firms}) \quad (13)$$

The procedure to find matched firms is described earlier. A wealth relative exceeding one is interpreted as IPOs outperforming the matched firm benchmark, while a value below one indicates underperformance.

4.4. *Profit forecast accuracy and initial returns*

The regression model we use to test the relationship between the initial stock returns on an IPO and the forecast error is taken from Chen and Firth (1999). According to the model, the issue price is a function of the earnings forecast and the 'underpricing' is a fixed percentage. Then, any variation in the initial return will be a function of investors' perceptions of the accuracy of the earnings forecast (ex-post realisations of forecast errors are used as proxies of ex-ante perceptions). The model is:

$$\text{IR} = \beta_0 + \beta_1\text{FE} + \beta_2\text{PEMR} + \beta_3\text{SIZE} + \beta_4\text{AGE} + \beta_5\text{MKT} \quad (14)$$

where

IR = percentage return on the IPO stock on the first day of trading;

FE = percentage forecast error given by equation (1);

PEMR = price earnings relative calculated as the PE of a matched firm divided by the PE of the IPO firm. The PE of the IPO firm is the issue price divided by the forecast earnings per share;

SIZE = the log of the market capitalisation of the IPO;

AGE = log of the number of years since the IPO firm was established; and

MKT = market return on the listing date of the IPO (we use the return on the comparison firm in a supplementary regression).

A positive sign is hypothesised on the FE variable (Chen and Firth, 1999). Another approach to explain the relationship between forecast accuracy and initial returns is the model of Benveniste and Spindt (1989). According to this model, the initial return is a positive function of uncertainty, which we measure by FE. In other words, the higher the forecast error, the higher the uncertainty and the larger the underpricing. The ex-post measure, FE, is used as a proxy for investors' expectations of forecast accuracy.

Firth and Liau-Tan (1997) posit that one stock valuation technique used by investors and financial analysts is to multiply the published earnings forecast by an 'appropriate' price earnings (PE) ratio. In the initial public offering, the appropriate price earnings ratio can be estimated from the PE ratios of firms already listed on the market. Therefore, the expected initial stock return is a function of the proportionate difference in price earnings ratios, i.e., the ratio used by the issuer and the 'appropriate' ratio. In order to test this conjecture, the ratio between the price earnings ratio of a matched listed firm (the appropriate ratio) and the price earnings ratio of the IPO firm is calculated; this variable is denoted PEMR. According to Firth (1997) the expected sign for PEMR is positive. To operationalise PEMR for each IPO, a matched listed firm in the same industry, and which is nearest in size, is chosen as a benchmark (see the description earlier).

Size and age are used as control variables. Both of them are used as proxies for the company risk factor (Ritter, 1984; Beatty and Ritter, 1986). Moreover, size and age also act as a proxy for the accessibility of information for investors. Mauer and Senbet (1992) argue that investors can exploit the information from large size firms and older firms much more easily than they can from small size firms and young firms. Thus, large size firms and older firms pose a lesser degree of incomplete spanning in the secondary market. In Benveniste and Spindt (1989), size and age can reduce information friction during the IPO process. All these models predict that size and age are negatively correlated with the degree of underpricing. Thus, initial returns are expected to exhibit a negative relationship with issue size and age. Issue size is measured by the total Baht value of the offering (gross proceeds). Market return is used as a control variable. If the market index changes then this is likely to have a positive relationship with initial return.

Jelic et al. (2001) examined the relationship between initial returns and forecast accuracy in Malaysia and they included retained ownership and underwriter[5] as control variables. Neither of these variables is significant. As a result of this evidence we do not use retained ownership and underwriter in our analysis. Additionally it is not clear how retained ownership should affect initial return and market value. While high retained ownership leads to high market value in the Leland and Pyle (1977) model, an opposite prediction is given by the entrenchment and expropriation arguments.[6] Identifying high quality underwriters is problematic in Thailand (there is no consensus as to who is high quality or high prestige) and so we do not include underwriter in our model.

4.5. Forecast accuracy and aftermarket performance

The earnings forecast is a major factor in valuing new issues and so errors in these forecasts are expected to be an important determinant of aftermarket stock performance. IPOs whose reported earnings exceed their forecasts are likely to experience higher abnormal returns in the first year after issue, and those whose earnings are less than expected are likely to suffer lower CARs. To measure the relationship between CARs and the aftermarket performance, the following regression is used:

$$CAR_{year\ 1} = \alpha_0 + \alpha_1 IR + \alpha_2 SIZE + \alpha_3 AGE + \alpha_4 MKT + \alpha_5 FE + \alpha_6 BV/MV \quad (15)$$

where

$CAR_{year\ 1}$ = one-year cumulative adjusted return using the SET index as the benchmark (alternatively a comparison firm and a one-year wealth relative are used as the benchmark);
IR = initial stock return of the IPO firm;
SIZE = log of the market capitalisation of the IPO;
AGE = log of the number of years since the IPO firm was established;
MKT = return on the stock market in the month preceding the issue date;
FE = percentage forecast error as given by equation (1); and
BV/MV = book-to-market ratio measured as at the first day of trading of the IPO.

The overreaction hypothesis[7] predicts that the initial returns are negatively correlated with the aftermarket performance of IPOs. Ritter (1991) documents a negative association between the magnitude of first-day returns and aftermarket performances in his study in the United States. SIZE, AGE, MKT, and BV/MV are used as control variables.[8] Ritter (1991) and Levis (1993) find that small size issues have the poorest aftermarket performance. Ritter (1991) also finds a positive relationship between age and aftermarket performance of IPOs. We hypothesise that FE will be positively correlated with CARyear 1 if investors use earnings forecasts in pricing IPOs. If the forecasts turn out to be erroneous, stock prices should react accordingly.

5. Empirical results

5.1. Direction of bias and accuracy of forecasts

Descriptive statistics of the forecast errors and absolute forecast errors are shown in Table 2. The mean and median FEs are negative at –6.86% and –4.02%, respectively. Note, however, the standard deviation of FE is high and so the mean and median forecast errors are not significantly different from zero (0). The negative signs on the mean and median FE indicate that IPO earnings forecasts are optimistic in the sense that the actual earnings is less than forecast. In contrast, mean forecast errors in China (Chen and Firth, 1999), Hong Kong (Cheng and Firth, 2000), Malaysia (Jelic et al., 1998, 2001), and Singapore (Firth et al., 1995) are positive and thus represent pessimistic forecasts. The mean and median AFEs are 35.76% and 20.83%. These absolute forecast errors are comparable to those observed in other East Asian countries.

Table 2 also shows the AFEs that result from using the random walk model (RW) and the growth (G) model to predict earnings. Clearly the two time series models do a much poorer job of predicting earnings as the forecast errors are much larger. Table 2 also splits the results into two subperiods, 1991 (n = 47) and 1992 to 1996 (n = 128). The reason for this split-up is that in 1991 earnings forecasts were voluntary while from 1992 to 1996 they were compulsory. The sub-pe-

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[5] Titman and Trueman (1986) developed a model where a high quality auditor and investment banker increases firm value. However, firm value is not a consideration in our study.

[6] High retained ownership gives the controlling shareholder (usually the original owner before lising) a great deal of power and they may use this to expropriate assets from the minority owners. As a consequence of this agency problem, stock prices may be lower.

[7] See De Bondt and Thaler (1985, 1987) for a general discussion of overreaction in stock markets.

[8] For reasons previously stated, we do not include retained ownership and underwriter variables in our model.

Table 2
Descriptive statistics of the forecast errors

Forecast accuracy	*No.*	*Mean*	*Median*	*Max*	*Min*	*St. dev.*
FE	175	–0.0686	–0.0402	2.9841	–3.7000	0.6091
1991	47	–0.0765	–0.0250	1.76	–3.7000	0.7894
1992–1996	128	–0.0658	–0.0472	2.9841	–1.52	0.5316
AFE	175	0.3576***	0.2083***	3.7000	0.0067	0.3576
1991	47	0.4270***	0.1976***	3.7000	0.0067	0.6654
1992–1996	128	0.3321***	0.2108***	2.9800	0.0100	0.4193
AFE(RW)	175	0.7340***	0.3415***	20.8571	0.0000	1.9273
1991	47	0.6910***	0.3967***	3.53	0.0200	0.8615
1992–1996	128	0.7497***	0.2969***	20.8571	0.0000	2.1954
AFE(G)	175	3.4221***	2.0451***	19.1104	0.0035	3.7567
1991	47	3.6036***	2.0438***	19.1104	0.0035	4.2636
1992–1996	128	3.3517***	2.1114***	17.4717	0.0064	3.5584

Note: ***Statistically significant at the 0.01 level.
Forecast Accuracy for each IPO is measured in terms of Forecast Error (FE) and Absolute Forecast Error (AFE). FE is the forecast error given by $FE = (AP - FP)/|FP|$ where AP is the actual earnings and FP is the forecast earnings. AFE is the absolute value of FE. AFE(RW) is computed as the absolute value of the error metric where the forecast earnings is the latest earnings; this is a random walk model. AFE(G) is the absolute value of the error metric where the forecast value is the latest earnings multiplied by the two year annually compounded growth rate of earnings per share prior to listing. FE measures bias. AFE, AFE(RW), and AFE(G) measure absolute errors of managers' forecasts, a random walk model, and a growth model, respectively. The null hypothesis is that FE, AFE, AFE(RW), and AFE(G) are zero (i.e., forecasts have no bias (FE) and have no error (AFE, AFE(RW), and AFE(G))).

riod results are quite close to each other and to the overall results. Based on t-tests there are no significant differences in FE, AFE(RW), and AFE(G) across the two time periods. However, AFE is significantly higher in 1991 than in 1992–1996 (t = 2.25). To formally test *H1* and *H2*, we compare the accuracy of IPO forecasts and forecasts generated from the RW and G models. Table 3 shows the results for DIFF(RW) and DIFF(G). The AFEs of the random walk and growth models are significantly greater than those of management (published in the IPO prospectus). Table 3 also shows the results of the superiority measures developed by Brown et al. (1987). The mean SUP(RW) and SUP(G) are positive and significant, which further corroborates the argument that managers' forecasts add value over and above forecasts based on time series models. The sub-period results (1991 and 1992–1996) are quite similar and the differences in means are not statistically significant.

5.2. Bias and rationality

We use the regression approaches of De Bondt and Thaler (1990) and Capstaff et al. (1995) to examine the bias and rationality of forecasts. The results from running regression equation (7) are shown in Table 4; Panel A shows the results using management's forecast of earnings, and Panel B shows the results using a growth model to predict earnings.[9] In both panels, the dependent variables are the actual earnings changes while the independent variable captures the forecast earnings changes from the previous year. Heteroskedastic consistent standard errors are used to compute the t-statistics (White, 1980); White's technique is also used in the other regressions (equations (14) and (15)).[10] The regression results shown in Table 4 indicate that changes in the earnings of IPO firms can be explained by forecast earnings when the forecast values are obtained from the IPOs' offering prospectuses. The adjusted R-square is 0.769 and the F-value is significant at 581.427. In contrast, using the naïve forecasts (see Panel B) does not explain changes in earnings; the adjusted R-square and the F-value are 0.003 and 0.572, respectively. The Durbin-Watson statistics (2.03 in Panel A and 1.93 in Panel B) show that autocorrelation is not an important factor in the regressions.

The regression coefficient in Panel A of Table 4 shows that β is not significant and so there is little evidence of systematic bias. The coefficient indicates managements overreact in their forecasts since the value of β is significantly less than one.[11] In Panel B, the coefficient is far less than one (1) and it is not statistically different from

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[9] Sub-period results are very similar to the results for the whole period and so they are not separately reported here.

[10] The substantive results in all the regressions (equations (7), (14), and (15)) remain the same when we do not use White's technique. In particular, the significance levels of the coefficients (0.05, 0.10, and not significant at 0.10) remain the same.

Table 3
Forecast superiority measures

Forecast accuracy	*Mean*	*Median*	*Max*	*Min*	*St. dev.*
DIFF(RW)	0.3764***	0.0654***	20.6458	–2.4459	1.9050
1991	0.2639**	0.1290***	3.3711	–1.4784	0.7539
1992–1996	0.4176**	0.0517***	20.6458	–2.4459	2.1817
DIFF(G)	3.1634***	1.7102***	19.4230	–0.6653	3.9462
1991	3.1622***	1.6518***	19.4230	–0.4923	4.2382
1992–1996	3.0236***	1.8865***	18.4235	–0.6653	3.5510
SUP(RW)	0.4219***	0.2890***	4.1300	–3.1900	1.3241
1991	0.6644***	0.4289***	4.1300	–1.5700	1.2967
1992–1996	0.3327***	0.2827***	3.7500	–3.1900	1.3280
SUP(G)	1.2030***	1.1563***	4.4200	–2.8800	1.4762
1991	1.2402***	1.1477***	3.7200	–1.8700	1.3519
1992–1996	1.1852***	1.1594***	4.4200	–2.8800	1.5189

Notes: ***Statistically significant at the 0.01 level.
** Statistically significant at the 0.05 level.
DIFF(RW) is the difference between AFE(RW) and AFE. DIFF(G) is the difference between AFE(G) and AFE. AFE(RW) and AFE(G) are the mean absolute forecast errors using the last earnings as a forecast of earnings and the last earnings with growth as a forecast of earnings, respectively. They are computed as AFE(RW) = $|(AP - RWF)/RWF|$ and AFE(G) = $|(AP - GF)/GF|$ where RWF is the latest earnings before listing. GF is the product of the latest earnings multiplied by one plus the annual compound growth in earnings over the three years prior to listing. AFE is the absolute forecast error. SUP(RW) and SUP(G) are the forecast models as used by Brown et al. (1987). The null hypothesis is that managers' forecasts are no better than random walk model and growth model predictions. A positive significant value indicates managers' forecasts are more accurate.

Table 4
Regression results on forecast accuracy

Panel A: $(AP_t - AP_{t-1})/AP_{t-1} = \alpha + \beta(FP_t - AP_{t-1})/AP_{t-1}$

Variable	*Value*	*t-value*
α	–0.109	–1.423
β	0.808***	24.113
Adjusted-R^2	0.769	
F-value	581.427	
Durbin-Watson statistic	2.03	

Note: *** Statistically significant at the 0.01 level (the β coefficient is significantly different from zero). The t-value is 5.729 for the hypothesis that $\beta = 1$ (i.e. the coefficient is statistically smaller than one (1)).

Panel B: $(AP_t - AP_{t-1})/AP_{t-1} = \alpha + \beta(AP_{t-1}{*}G - AP_{t-1})/AP_{t-1}$

Variable	*Value*	*t-value*
α	0.092	0.543
β	–0.091	–0.756
Adjusted-R^2	0.003	
F-value	0.572	
Durbin-Watson statistic	1.93	

Notes: The t-value for b =1 is 9.06. β is therefore statistically smaller than one (1).
Regression analyses are used to capture the bias and under/over reaction of the forecast. In Panel A, we use equation (7), $(AP_t - AP_{t-1})/AP_{t-1} = \alpha + \beta(FP_t - AP_{t-1})/AP_{t-1}$ where AP is the actual earnings and the FP is the forecast earnings as published in the offering prospectus. In Panel B, we replace forecast earnings, FP_t, with last year's earnings multiplied by a growth factor, $AP_{t-1}{*}G$. The t-values are computed using the White (1980) heteroskedasticity-consistent estimate of the standard errors of the coefficients.

Table 5
Cross-sectional regression of absolute forecast errors: descriptive statistics

Panel A: Descriptive statistics of the variables

Variables	*mean*	*median*	*Max*	*Min*
SIZE	8584.50	2821.10	154415.49	226.01
AGE	20.21	13.17	91.19	2.42
VARIAT	0.41	0.50	14.94	–51.11
LEVER	0.60	0.62	0.97	0.03
LENGTH	173.98	158.00	363.00	3.00
MKT	–0.25	–0.38	5.30	–7.25

Panel B: Regression results

Variables	*Coefficients*	*t-value*
Intercept	0.096	0.739
SIZE	0.181**	2.386
AGE	–0.007	–0.090
VARIAT	0.046	0.614
LEVER	0.070	0.905
LENGTH	0.150**	1.956
MKT	0.016	0.213
Adjusted-R^2	0.020	
F-value	1.585	
Durbin-Watson statistic	2.10	

Note: ** Significant at the 0.05 level
This table shows the regression results when absolute forecast error (AFE) is the dependent variable. Explanatory variables are as follows: SIZE is the log of the market capitalisation of the IPO. AGE is the log of the number of years since the IPO firm was established. VARIAT is the coefficient of variation for the last 3-years earnings of the IPO firm before listing. LEVER is the total debt divided by total assets of the IPO firm. LENGTH is the log of the number of days between the prospectus date and the fiscal year-end. MKT is the return on the stock market in the month preceding the issue date. The t-values are computed using the White (1980) heteroskedasticity-consistent estimate of the standard errors of the coefficients.

zero (0).

The evidence from Table 3 and Table 4 indicates that earnings forecasts derived from IPO prospectuses are more accurate than earnings forecasts using simple naïve prediction models. In other words, earnings forecasts made by management in IPO prospectuses predict future earnings quite well and are therefore valuable to investors.

5.3. Cross-sectional explanatory model of forecast error

In this section, we report the results of the regression models that explain the magnitude of absolute forecast errors (AFE). We employ variables that have been frequently used in previous studies (Cheng and Firth, 2000; Jaggi, 1997; Jelic et al., 1998). These factors include company size, age, leverage, variation in historical earnings, forecast period, and market returns. Table 5 shows the descriptive statistics of the explanatory variables (Panel A) and the regression results (Panel B).[12] The mean market capitalisation is 8,584m. baht when using the offering price. On average, the firms are well established before listing on the SET with a mean (median) age of 20 years (13 years). Prior to the listing dates, the IPOs' three-year earnings numbers show some variability and, on average, have a coefficient of variation (standard deviation divided by its mean) equal to 0.41. The mean leverage (total debts divided by total assets) is 0.60, with a maximum value of 0.97. The average number of days between the prospectus date and the end of the year is 174 days. An examination of the correlation matrix of the independent variables indicates that multicollinearity is not a problem. The highest correlation is 0.14 between AGE and LENGTH; this correlation is well below the levels that indicate a major problem (Judge et al., 1988). The variance inflation factors are below two and this provides further evidence that multicollinearity is not a problem.

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[11] The t-value reported in Table 4, Panel A, is for $\beta = 0$. The t-value for $\beta = 1$ is 5.729 and this is significant at the 0.01 level. The β of 0.808 is significantly greater than zero (0) and is significantly less than one (1).

[12] Sub-period results are very similar to the results for the whole period and so they are not separately reported here.

Table 6
Initial returns of the IPOs

Panel A: Descriptive statistics of initial returns

Total number of IPOs	175
Mean initial return (%)	36.55
St. dev. of the initial return	53.36
Median of initial return (%)	25.00
Max. of initial return (%)	465.00
Min. of initial return (%)	–39.39
Number of Underpriced Firms	138
Percentage	78.8%
Number of Overpriced Firms	35
Percentage	20%
Number of Normal priced Firms	2
Percentage	1.2%

Panel B: Distribution of initial returns

Distribution of initial returns	*No. of firms*
> 100%	14
> 90 – 100	10
> 80 – 90	6
> 70 – 80	7
> 60 – 70	7
> 50 – 60	9
> 40 – 50	14
> 30 – 40	14
> 20 – 30	14
> 10 – 20	16
> 0 – 10	27
> –15 – 0	24
> –30 – –15	7
> –45 – –30	6
Total	175

The sample is drawn from IPOs that listed on the SET during 1991 to 1996. Initial return is defined as the first day's closing price minus the offering price and divided by the offering price. 'Underpricing' are cases where the initial returns are greater than zero. 'Overpricing' are cases where the initial returns are less than zero. Normal pricing is when the initial returns are zero.

Panel B of Table 5 indicates that firm size (SIZE) is significantly and positively related to absolute forecast error (AFE) at the 0.05 level. However, this direction is opposite to the expected sign. In other words, we find that large IPO firms forecast their earnings with more error when compared to the forecasts made by small IPO firms. Also, we find that LENGTH is positively and significantly related to AFE at the 0.05 level. Thus, longer forecast horizons have greater forecast errors. The other variables are not statistically significant. The overall fit of the model is poor with an adjusted R-square of 0.020. The Durbin-Watson statistic is 2.10 and this indicates autocorrelation is not a problem in the regression.

5.4. The initial returns on IPOs

The initial returns of 175 IPOs that were listed on the Stock Exchange of Thailand during 1991–1996 are reported in Table 6. The mean return is 36.55%, the median is 25.0%, the maximum value is 465% (which was the return of Samart Corporation (SAMART) on December 23, 1993), and the minimum return is –39.39% (which is the return of CVD Entertainment (CVD) on July 5, 1994). We find that 79% of the total sample (138 firms) has an offering price lower than their first-day closing price (i.e. the shares are underpriced). Of the 175 IPOs, 20% (35 firms) suffer overpricing and only 1% of them are priced equal to their first day closing price. Panel B of Table 6 shows

Table 7
Cross-sectional explanation of initial returns: regression results

Variables	*Coefficients*	*t-value*
Intercept	70.747**	4.845
FE	13.580*	1.821
PEMR	–0.003	–0.183
SIZE	–0.002	–1.164
AGE	–27.602**	–2.277
MKT	5.217*	1.671
Adjusted-R^2	0.046	
F-value	2.541**	
Durbin-Watson statistic	2.15	

Notes: ** Significant at the 0.05 level
*Significant at the 0.1 level
Regression analysis is used to explain the initial returns of IPOs as per the following equation:

$$IR = \beta_0 + \beta_1 FE + \beta_2 PEMR + \beta_3 SIZE + \beta_4 AGE + \beta_5 MKT$$

IR is the percentage return on the IPO stock on the first day of trading. FE is the percentage forecast error given by equation (1). PEMR is the price earnings relative calculated as the PE of a matched firm divided by the PE of the IPO firm; the PE of the IPO firm is the issue price divided by the forecast earnings per share. SIZE is the log of the market capitalisation of the IPO. AGE is the log of the number of years since the IPO was established. MKT is the stock market return on the listing date of the IPO. The t-values are computed using the White (1980) heteroskedasticity-consistent estimate of the standard errors of the coefficients.

the distribution of the initial returns; clearly there is a lot of variability in the initial returns.

5.5. Initial returns and forecast errors

We use regression equation (14) to explain the variability in initial returns and the results are reported in Table 7.[13] Initial return (IR) is significant and positively correlated with the forecast error (FE) at the 0.1 level (two-tail test). The positive coefficient on FE confirms our hypothesis that forecast error is a proxy of ex-ante uncertainty and is positively correlated with the initial return of IPOs. The negative and significant relationship between age of firm and initial return (IR) is also consistent with the ex-ante uncertainty model (Beatty and Ritter, 1986). In this case, investors know more about older firms and so uncertainty is lower. The relative price earnings ratio (PEMR) is not significant; this result contrasts with Firth's (1997) study of IPOs in New Zealand. One reason for the non-significance of PEMR is that it is difficult to find good matches for IPO firms. SIZE is not significant. The initial return is a function of the return on the market index (MKT) and is significant at the 0.10 level. The adjusted R-square is 0.046 and the Durbin-Watson statistic is 2.15 (this indicates autocorrelation is not a problem). In a supplementary regression we substitute the stock return of a portfolio made up of the comparison firms for MKT. The results are qualitatively the same as those for MKT and so we do not tabulate them here.

5.6. Accuracy of forecasts and the after market performance of IPOs

Firth (1997) proposed a hypothesis that predicts a positive relation between earnings forecast accuracy and future-period CARs. An intuitive explanation for this is that, subsequent to listing, investors will be constantly evaluating how accurate they believe the forecasts to be and they will revise their price expectations accordingly. With this framework, we run a regression analysis to investigate the relationship between the aftermarket performance of IPOs (represented by the CAR) and the accuracy of the profit forecast published in the offering prospectuses (FE). One-year CARs are calculated according to equation (12). We find a negative CAR of –8.83% when using the SET as a benchmark and 3.86% when using a comparison firm as a benchmark, and we find a wealth relative (WR) of 0.97. In the first case, the CAR is statistically significant at the 0.10 level using the method of Ritter (1991) and Loughran and Ritter (1995); in the second case, the CAR, computed against a comparison firm benchmark, is not statistically significant. The wealth relative of 0.97 indicates slight underperformance. To assess whether forecast accuracy has an effect on one-year aftermarket stock returns, we use regression equation (15), where CAR is the dependent variable and FE is an independent variable. Other control variables are

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[13] Multicollinearity is not a problem (correlations are low and the VIFs are below two).

Table 8
Cross-sectional explanation of CARS: regression analysis

	Dependent variable					
	$CAR_{year\ 1}$		$CAR_{year\ 1}$ (Comparison firm)		$WR_{year\ 1}$	
Variables	*Coefficients*	*t-value*	*Coefficients*	*t-value*	*Coefficients*	*t-value*
Intercept	2.239	0.214	4.971	1.032	0.887	3.162***
IR	–0.004	–0.974	–0.109	–0.987	–0.018	–0.743
SIZE	–0.005	–0.682	1.889	1.08	–0.034	–0.710
AGE	2.946	0.463	1.436	0.878	0.136	0.501
MKT	–0.526	–0.33	0.83	1.416	0.002	0.474
FE	3.539	1.024	4.263	1.067	0.392	1.158
BV/MV	8.449	0.911	10.572	0.225	0.082	0.643
Adjusted-R^2	0.012		0.029		0.034	
F-value	0.959		1.483		1.861	
Durbin-Watson statistic	1.96		2.05		1.89	

Note: *** Significant at the 0.01 level.
The regression analysis uses the equation:

$$CAR_{year\ 1} = \alpha_0 + \alpha_1 IR + \alpha_2 SIZE + \alpha_3 AGE + \alpha_4 MKT + \alpha_5 FE + \alpha_6 BV/MV$$

Where $CAR_{year\ 1}$ is the one-year cumulative adjusted return using the SET index as the benchmark (alternatively a comparison firm is used as the benchmark). WR_{year1} is the one-year wealth relative (one plus the buy and hold one-year returns on the IPO stocks divided by one plus the buy and hold one-year returns on the comparison firm stocks). IR is the initial stock return of the IPO firm. SIZE is the log of the market capitalisation of the IPO. AGE is the log of the number of years since the IPO firm was established. MKT is the return on the stock market in the month preceding the issue date. FE is the percentage forecast error as given by equation (1). BV/MV is the book-to-market ratio measured as at the first day of trading of the IPO. The t-values are computed using the White (1980) heteroskedasticity-consistent estimate of the standard errors of the coefficients.

the initial return (IR), log of the size of the firm (SIZE), log of the age of the firm (AGE), the book-to-market value (BV/MV), and stock market return (MKT). An examination of the correlations and VIFs indicate that multicollinearity is not a problem. CAR is measured relative to the SET index, relative to comparison firms, and as a wealth relative (WR). The results of the regression are presented in Table 8.[14] The explanatory power of the models is very poor and control variables are not significant; the Durbin-Watson statistics indicate that autocorrelation is not a problem. Our main variable of interest, FE, has a positive coefficient (as expected) in both regressions but it is not statistically significant. Thus we have directional, but not statistical, support for our hypothesis.

6. Conclusion

Unlike the US, where new issues are marketed to select investors, IPOs in Thailand are sold to the general public. This makes the problems of information asymmetry more acute. In order to reduce information asymmetry, the managers of firms making IPOs in Thailand are required to disclose an earnings forecast for the forthcoming year. These forecasts include the impact of expansion that is financed by the IPO proceeds. Historical earnings are likely to be less informative to investors than management's view of the future earnings. Reputation effects and the possibility of criminal and civil prosecutions in the case of wilful misrepresentation are likely to curtail particularly egregious cases of over- and under-forecasting.

Our study is the first to investigate the accuracy of IPO earnings forecasts in Thailand and their associations with both underpricing and longer-term stock returns. We find that IPO forecasts are, on balance, optimistic, with the actual earnings being lower than those forecast. The absolute forecast errors are somewhat higher than those reported in Hong Kong, Malaysia, and Singapore (other jurisdictions in South East Asia where earnings forecasts are made). Managers' forecasts are, however, significantly more accurate than those estimated from time series models. Thus earnings forecasts published in IPO prospectuses are informative for investors. Our tests indicate there is little evidence of systematic bias although there is evidence of overreaction. The size of the IPO firm and the time horizon of the forecast are related to the magnitude of the error.

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[14] Sub-period results are very similar to the results for the whole period and so they are not separately reported here.

Similar to other countries, there is substantial underpricing of IPOs. We find that forecast error is significantly and positively related to the underpricing and this suggests investors can predict the error and factor it into pricing. Forecast error is positively related to long-term stock returns and wealth relatives (WR) but it is not significant.

Earnings forecasts published in IPO prospectuses provide valuable information to investors. They are more accurate than extrapolations of historical earnings and there is some evidence that they are used to help price the shares in the immediate aftermarket. However, the exact nature of how investors factor earnings forecasts into the pricing of IPO stocks awaits further research. Although providing forecasts can be open to abuse, there is no evidence that there are widespread problems or malpractices in the Thai stock market.

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Book Reviews

Through the eyes of management: narrative reporting across three sectors (final report).
Vivien Beattie, *Bill McInnes* and *Stella Fearnley*. Institute of Chartered Accountants in England and Wales. London, September 2004. ISBN 1 84152 236 8. xx + 139pp. £20.

This report is one of four parts of a large study of stakeholder reporting and user needs. The study has two stages and this final report completes the first stage, which comprises two reports by the same authors on narrative reporting. The first report, *Through the Eyes of Management: A Study of Narrative Disclosures* published in June 2002, analysed narrative reporting practices in the annual reports for 1999 of 11 companies in a single industry, the food-processing sector. This final report extends the study to three sectors (Food processing, Textiles and leather goods, Water).

The research uses a computer-assisted linguistic methodology to document narrative disclosures in company annual reports. Disclosure quality is measured in the form of a narrative disclosure profile (*Disclosure Profile*™). Disclosures are analysed over four dimensions:

1. Topic: Nine topic categories, and 79 sub-topics are identified, based on the comprehensive model of business reporting developed in the Jenkins Report (AICPA, 1994).*
2. Time orientation: historical, forward-looking and non-time specific.
3. Financial orientation: financial and non-financial.
4. Quantitative orientation: quantitative (amount in £); change (e.g. in %); other; and non-quantitative (fact, judgment, other).

The sample is small at 27 companies. However, this small sample size belies the extent of data analysis – 12,293 separate narrative disclosures were analysed. The content analysis methodology is described in considerable detail and is a model for other content analysis researchers to follow.

Analysis of disclosures is performed at the macro-level (by company) and micro-level (by topic and attributes). The macro-level analysis examines the main narrative sections and their relative and absolute sizes. Chairmen's statements and Operating and Financial Reviews are separately considered. On average, approximately one-fifth of annual reports are devoted to narrative disclosures with considerable variation in length between the 27 companies (2–59 pages).

Of the nine main topics, information was primarily descriptive, focussing on the business, financial information or directors' biographical details. Although acknowledged as being of critical importance, operational, analytical, forward-looking and strategic topics were less common. The majority of disclosures fell into only 10 of the 79 sub-topics, showing a further imbalance across topics and sub-topics.

Imbalance is also found in relation to disclosure type attributes. Only 14% of disclosures were forward-looking compared with 70% historical. There were 37% financial disclosures compared with 63% non-financial. Quantitative disclosures accounted for 22% of narrative disclosures compared with 78% non-quantitative disclosures.

The influence of size (two categories: large and small companies) and industry (three industries) on narrative disclosures was tested. Multivariate stepwise regression examined the influence of eight independent variables: company size, gearing, complexity (number of subsidiaries), complexity (number of segments), performance (return on equity), industry, multiple listings and auditor type (Big-Five, other).

Results show that size and multiple listings have a significant positive influence on narrative disclosures, while number of segments has, contrary to expectations, a significant negative influence.

Because of the in-depth nature of the analysis, the results are not an easy read. For example, there are 27 Tables/Figures of results, many of which are dense and long. More detailed findings, including examples from annual reports, are reported in a separate *Supplementary Findings* document, which can be downloaded from the ICAEW website.

The authors make three recommendations:

1. Narrative disclosures should be more structured.
2. Disclosures should be made over a broader range of topics.
3. Quality of some disclosures should be improved (more quantified, forward-looking disclosures).

The authors also comment on nuisance disclosures which can taint an annual report such that the reader will not read further or will be sceptical about other disclosures. This points to another complementary stream of narrative disclosure research – impression management, whereby management manipulates company outsiders' perceptions and decisions of company performance and prospects. I hope this most interesting angle is covered in the next stage of the study.

The authors are to be commended for taking on such painstaking, labour-intensive research. In so doing, they have added considerably to our understanding of company narrative disclosures. I look forward to the results of the second stage of their study: (i) On disclosures choices using three case studies, and (ii) On the importance of different communications channels and types of information to stakeholder groups using a single case company.

University College Dublin Niamh Brennan

*American Institute of Certified Public Accountants (AICPA) (1994). *Improving Business Reporting – A Customer Focus: Meeting the Information Needs of Investors and Creditors.* Comprehensive Report of the Special Commission on Financial Reporting (The Jenkins Report). New York NY: American Institute Of Certified Public Accountants.

The role of auditors, reporting accountants and skilled persons in UK financial services supervision. *Ian Dewing* and *Peter Russell.* ICAS, 2005. v + 121pp. £15.

The Financial Services and Markets Act 2000 (FSMA 2000) brought the regulation of UK financial services into the hands of the Financial Services Authority (FSA) from 1 December 2001, replacing separate regulators for banks, buildings societies, insurance companies and friendly societies. Dewing and Russell continue their work with this short study of financial services regulation pre- and post- 1 December 2001 (a date referred to throughout as N2).

Their method is to review the published rules and interpretations, and to interview key actors: mostly regulators, auditors, and officers of financial services firms. They set out four 'specific research questions' (p.4) for this study:

(i) What is the exact nature of the role of auditors and reporting accountants/skilled persons for financial services firms as specified in legislation, and supplementary interpretation and guidance by regulators and the profession?
(ii) What are the perceptions of key interested parties about the rôle of auditors and reporting accountants/skilled persons in financial services? Does this accord with the rôle as set out in legislation and guidance? Has a new expectations gap emerged? What are the implications?
(iii) Does the nature of the dual role of auditors and reporting accountants/skilled persons of financial services firms enhance or compromise the requirements of key interested parties?
(iv) How do European and international arrangements differ from the UK?

The authors conducted 64 interviews: 34 with financial services firms, 11 with auditors, eight with regulators and 11 with 'others'. Views were collected, and anonymous extracts quoted, on questions (i) to (iii), although (iv) was barely addressed. Dewing and Russell sum up how the regulations were operating before N2, although the latest versions had not long been in force by that stage (e.g. banks, were then regulated by the Banking Act 1987, and the procedures changed substantially after the failure of Barings in 1995, after which risk assessment became the focus rather than systems review).

The regulation of banks seems to have become somewhat more relaxed after N2, whereas insurance regulation has been tightened. Thus, bank auditors reported annually under s.39 Banking Act 1987, supplemented by frequent meetings between regulators, auditors and financial services firms. After N2, these regular reports were replaced by ad hoc reports under s.166 FSMA 2000, and these are now on an infrequent basis (particularly for those financial services firms identified as offering low risk to the FSA). The respondents seemed to agree that little difficulty arose, either pre- or post-N2, over the dual lines of responsibility of auditors (to shareholders and to regulators) since their interests overlap.

The study is readable, and covers much ground. Inevitably, it lacks detail – partly for reasons of confidentiality. To my mind, its terms of reference focus too narrowly on respondents' views on the specific research questions, leaving precious little room to discuss the context of the regulatory processes (even within the UK, let alone within Europe or globally). This seems to me to matter, since UK financial services have been transformed over the past two decades. Their ownership and control are now global, rather than resting largely in the hands of a coterie of middle-aged men in London and Edinburgh. Computer dealings have replaced the handshake over a pint; derivatives now transfer risks and rewards anywhere around the world at a mouse-click; securitisation prevails in unfamiliar fields. Indeed, one wonders whether regulation at national level might not now be anachronistic. The interviews tend to concentrate rather upon how discussions are conducted, and how client confidentiality is observed; there is nothing on the broader lines of compliance reporting or on the regular financial and statistical returns that financial firms themselves are required to file – for example, under the Basle accord.

Dewing and Russell comment on their misgivings over how far independence can be assured when the small number of s.166 reports to date seem to have come from the Big Four auditing firms. (One would like to know more of the institutional detail, but this is off record.) It is accepted all round that the auditors already possess detailed access to the operational and strategic details of their clients, and that it would be costly to replicate such knowledge. But, as Dewing and Russell note, post-Enron there is strong pressure for auditors to reduce consultancy-style involvements with their clients.

The FSA seems to have a major task to keep abreast of its industry, but we are told nothing of the organisational details of how the FSA works or how it is staffed. It must be difficult to set limits to the scope of the FSA's work when UK activities constitute just part of a firm's global portfolio of deposit taking, lending, insurance and investment activities.

While I regret that the authors have kept to a relatively narrow brief, I cannot claim to be surprised. Indeed, they have managed to keep a complex picture remarkably clear. The result is an interesting read, and a good introduction to this specialised area.

University of Lancaster Michael J. Mumford

CALL FOR PAPERS

ACCOUNTING, BUSINESS AND FINANCIAL HISTORY

SPECIAL ISSUE
2007
Volume 17 (3)

Studies of Irish Accounting History

Guest editor: Ciarán Ó hÓgartaigh, Dublin City University

Accounting, Business & Financial History is an international, peer-reviewed journal which covers the areas of accounting history, business history and financial history. The journal provides contributors with an opportunity to publish the results of their research into mainstream aspects of accounting, business, and financial history, and also explores the interface between these three disciplines. A particular feature of the journal is its country-based special issues which are acknowledged as having played an important part in internationalising the study of accounting history.

This special issue invites contributions that explore the nature and context of Irish accounting, business and financial history. Irish accounting history is relatively under-explored but, as a cultural, political and economic setting, is a potentially rich seam of accounting history research. In that context, the special issue intends to broaden the canvass on which Irish accounting history is traced and also add colour and context to research in the area.

Submissions which reflect the social, political, economic and geographical context of Irish accounting history are particularly welcome. For example, the implications of Irish accounting history in areas such as the accounting profession, the practice of accounting and accounting education as well as the historical interactions between accounting and other social institutions are of interest. Similarly, much knowledge may be gained through studies of the influence of accounting in particular historical settings, such as in state institutions, the public service and in corporate settings. Further, studies which locate Irish accounting history in an international context, including the contribution of Irish accountants and accounting to accounting, business and financial change in other countries, are encouraged.

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Accounting on the frontline: cost accounting, military efficiency and the South African War

The effect of audit committee shareholding, financial expertise and size on interim financial disclosures

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Accounting and Business Research, Vol. 35. No. 4. pp. 295-305. 2005

The relationship between management accounting systems and perceived environmental uncertainty on managerial performance: a research note

Adebayo Agbejule*

Abstract—This study draws on both contingency and contracting theory to examine the moderating effect of perceived environmental uncertainty (PEU) on the relationship between the use of management accounting system (MAS) and managerial performance in Finnish companies. The responses of 69 managers, drawn from Finnish companies, to a questionnaire survey were analysed using a moderated regression analysis (MRA). The results found support for the hypothesis that the effects of MAS on performance were dependent on PEU. Under high levels of PEU, sophisticated MAS had a positive effect on performance, but under low levels it had a negative effect. Additional analysis showed that PEU interacts with different variations of MAS to influence performance.

1. Introduction

Researchers have suggested that environmental uncertainty has an important influence on the way in which managers process and use management accounting information (Gordon and Narayan, 1984; Gul, 1991; Mia, 1993; Gul and Chia, 1994). Management accounting systems (MAS) researchers (e.g. Chenhall, 2003) defined MAS as a formal system designed for providing managers with the requisite information to facilitate decision making and evaluation of managerial activity. Chenhall and Morris (1986) stated that information needs for decision-making might be considered in terms of general information characteristics. They suggested that each item of information has scope (information may be narrow or broad in its representation), level of aggregation (information may be detailed or aggregated), level of integration (information may be integrated) and timely (information is received in timely manner). Prior studies have supported the view that sophisticated MAS information is useful when the level of uncertainty is high (e.g. Gordon and Narayanan, 1984; Chenhall and Morris, 1986; Gul, 1991; Gul and Chia, 1994). Research studies on the issue of PEU and management accounting systems have tended to either focus on certain information characteristics or a composite measure[1] of management accounting system. In contrast, this study examines the potential overlap between the dimensions of MAS and how they influence managerial performance. For example, broad scope and integrated information can be provided in an aggregated form as well as in a detailed form. Similarly, the dimensions of scope, integration and aggregation can vary along the dimension of timeliness (Bouwens and Abernethy, 2000).

The purpose of this study is to shed further light on the generalisability issue by replicating and extending the study by Gul (1991) using a Finnish sample. We examine the moderating effect of PEU on the extent of use of the MAS information characteristics and managerial performance. Otley et al. (1994) consider replication 'a much neglected aspect of accounting research'. Accordingly, our first objective is to investigate whether Gul's (1991) findings of two-way interaction between composite measure of MAS and PEU affecting Australian managers' performance can be replicated on a Finnish sample. Our second objective is to investigate how the variations of MAS dimension interact with PEU to improve managerial performance.

Our study attempts to contribute to existing knowledge in several ways. First, we shed some light on the different variation that could exist between the use of MAS, PEU, and managerial performance. Specifically, we examine the two-way interactive effects between PEU and the variations in the use of MAS affecting managerial performance. Secondly, we integrate contracting theory

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The final version of this paper was accepted in June 2005.

[1] Four information characteristics of MAS dimensions added together to obtain one index of MAS.

and extant organisational research based on contingency theory to further our understanding of MAS design. Specifically, we examine different variations of MAS design that incorporates insights from contracting theory[2] and contingency theory,[3] and identify PEU and different variation of MAS that could enhance managerial performance. Another contribution of our study is to provide Finnish evidence related to the use of management accounting systems and managerial performance.

The paper is organised as follows: we begin with a theoretical discussion leading to a statement of our hypotheses. Subsequent sections present our research method, results, and limitations. Suggestions round off the paper.

2. Background literature

Most of the MAS-performance literature has been focused on American, Australian, and British firms. To our knowledge, there is no evidence of the study of this relationship in Finnish firms. In 2003, Finland was ranked as the most competitive country in the world (Cornelius et al., 2003) and consequently this has increased the international interest in the Finnish management accounting and business practices (Granlund and Lukka, 1998).

2.1. Prior studies

Most empirical studies on MAS-PEU-performance are based on the contingency framework. Empirical research on PEU in MAS-performance relationship has been classified either as antecedent or a moderator variable. For example, using moderated regression analysis, Gul (1991) and Gul and Chia (1994) had PEU as a moderator variable, and found that the effects of MAS on performance were dependent on the level of PEU. These results suggest the need for defining the type of contingency fit used. Venkatraman (1989) and Luft and Shields (2003) suggested that neglecting to specify the exact perspective of fit used in earlier studies may have led researchers to obtain contradictory, mixed, or inconsistent results (see later discussions on type of moderators). As mentioned earlier, prior studies in MAS-performance have focused on one or two information characteristics of MAS such as broad scope (Chong and Chong, 1997), aggregation and broad scope (Gul and Chia, 1994) and broad scope and timeliness (Tsui, 2001), whereas the composite measure of MAS was used in the study of Gul (1991). Researchers (e.g. Chenhall and Morris, 1986) studied each of the four information characteristics of MAS and treated them as conceptually distinct.

Researchers (e.g. Tiessen and Waterhouse, 1983; Christie et al., 2003) have discussed the application of contracting theory to the use of MAS. The availability and use of MAS can also be viewed as helping to direct the agent's behavior in accordance with the principal's interest. The contracting approach (including agency theory) suggests that MAS will be influenced by a variety of factors including environmental uncertainty (Tiessen and Waterhouse, 1983; Nilakant and Hayagreevia, 1994). However, none of the previous studies on MAS-PEU-performance linkages considered contracting theory.

To summarise, prior studies reveal the different roles of PEU in MAS-performance relationships, and how PEU relates to certain information characteristics of MAS to influence managerial performance. The next section draws on both contingency and contracting theory to examine the moderating effect of PEU on MAS-performance relationship.

2.2. The moderating role of perceived environmental uncertainty

Drawing upon the studies of contingency-based research, Gul (1991) and Gul and Chia (1994) suggested that when PEU is high, managers who use sophisticated reports from MAS could reduce uncertainty and improve managerial decision-making. A sophisticated broad scope MAS provides information related to the external environment and included is information that is economic and non-economic. Narrow scope information has been linked with traditional accounting systems in that these systems typically are limited to providing information that is internally focused, financial, and historically based information. When PEU is high, sophisticated MAS broad scope becomes essential for evaluating competitive actions or market demand. Timely information has the potential to reduce uncertainty. It enables decision makers to continually adjust their activities in response to changes in the environment. Managers would find the need to respond rapidly to changes in the competitive environment and market demand. As a result they would find timely and frequent MAS information particularly useful. The integrated dimension will also become increasingly important as PEU increases owing to its role in providing information for coordination among subunits. Galbraith (1973) suggested that, in uncertain situations, relevant information is required at the time and place of task execution and, further, a decentralised structure facilitates this information processing. From an accounting perspective, this suggests that managers operating in uncertain situations will have more autonomy over decision making and will therefore require information which may assist coordination.

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[2] This study relies on the framework of the theory of contracting costs. For detailed discussion of this theory, see Tiessen and Waterhouse (1983) and Christie et al. (2003). The main objective of the firm's contractual design is assumed to be to minimise contracting cost (including agency costs) between specialised factors of production. Accounting is part of contractual design and so it evolves to increase the efficiency of the contracts.

[3] The main proposition of contingency theory is that there must be an appropriate 'fit' between the internal organisation characteristics and the demand created by external environments in order to achieve organisational effectiveness. The notion of 'fit' is the key concept of contingency theory (see Drazi, and Van de Ven, 1985; Chenhall, 2003).

From the theory of contracting, accounting plays a vital role in a firm's contractual designs in organisations. Specifically, accounting systems are used in decision rights allocation, performance measurements, and reward mechanism. According to Jensen and Meckling (1992), informational variables are the key to value maximisation (managerial performance) because the quality of decisions is determined by the quality of information available to the decision maker. The co-location of information and decision rights enables the decision maker to make optimal decisions. There are two ways to bring information and decision rights together: (i) transfer the information required for the decision to the decision maker, using information systems such as MAS; or (ii) transfer the decision rights to the person with knowledge. The first approach generates knowledge transfer costs and the second generates control costs. The use of MAS is an example of accounting use in allocation of decision rights. In principle, the design of sophisticated MASs seems to provide the ability to move more knowledge up to the decision maker at lower cost. Minimising the total of knowledge transfer costs and control costs can increase value.

Following the contracting explanations, when managers faced with high PEU have better knowledge (information), performance is likely to improve. PEU and knowledge transfer costs are likely to be associated with expected and unexpected changes in the environment. For example, the quantity of information increases when the environment is changing rapidly, and delays in acting on information can cause that knowledge to become obsolete. Increased obsolescence rates and increased information flow increase the specialisation of knowledge (Christie et al., 2003). A delay in acting on sophisticated MAS information reduces its value. For this reason, when PEU is high, managers who receive and use timely MAS information would not only minimise transfer cost but also make timely decisions that can improve performance. Similarly, contracting theory suggests that if knowledge relevant to decision resides at the lower levels of the firm, then decentralization (decision right allocation) reduces knowledge transfer costs (Christie et al., 2003). While providing many general implications for the use of MAS, the theory of contracting in its present form in our study primarily provides insights into how economic actors respond to PEU and information provision within the context of improving performance.

In summary, both the contracting theory and organisational theory of PEU share some similar characteristics. Both theories view PEU as a lack of information that can be reduced by the acquisition of more information. In addition, both are concerned with strategies and mechanisms to reduce uncertainty. These mechanisms recognise the existence of different information processing characteristics and the possibility to combine these characteristics. Despite some differences[4] between the two perspectives, the overall conclusion between MAS and PEU is that the more uncertain the external environment, the more important it is that managers require sophisticated MAS information to cope with uncertainty and make decisions that are more appropriate (Chenhall, 2003). However, we argue that each of the dimensions of MAS is part of an organisation's information system and that managers may use different variations of MAS to help them cope with uncertainty. In other words, the critical question in the present study is: will PEU interact with different variations of the use of MAS to improve managerial performance? Or will PEU interact with certain information characteristics of MAS to influence performance?

2.3. *Hypothesis*

From the discussion above, when PEU is high managers who have sophisticated MAS information will be able to make decisions that are appropriate to cope with uncertainty and, consequently, improve performance. Thus, a high performing organisation is one in which the MAS information is matched with PEU (see Figure 1). Consequently, the following hypothesis is suggested:

H1: The higher the level of perceived environmental uncertainty (X_2), the more positive is the relationship between the use of MAS (X_1) and managerial performance (Y).

The term 'moderator' in this research refers to the role the variable plays within a research concern. According to Stone (1978), 'a moderator is any variable which when systematically varied causes the relationship between two other variables to change' (1978: 26). Sharma et al. (1981) further clarified the concept of a moderator by defining a framework for identifying and analysing the presence of such variables. They

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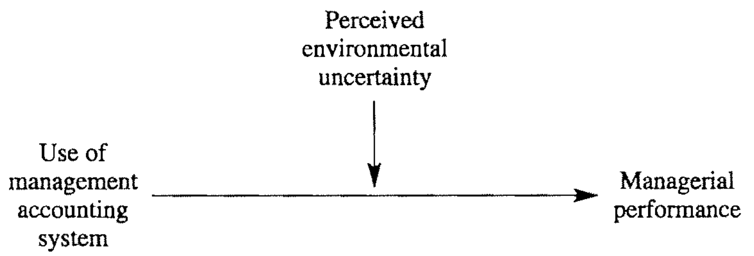
[4] However, agency theory has been criticised for ignoring some types of uncertainty, like the 'effect uncertainty' (e.g. Nilakant and Hayagreevia, 1994). For example, Nilakant and Hayagreevia (1994) suggested agency theorist overlook the fact that knowledge about the relations between the agent's effort and outcome may be incomplete. This is especially true in organisations where new technologies or products are developed.

Figure 1
The moderating effect* of PEU on the relationship between the use of management accounting system and managerial performance


Perceived environmental uncertainty
Use of management accounting system
Managerial performance

*Sharma et al. (1981) identified two types of moderators: a pure moderator and a quasi moderator. A pure moderator is one in which the moderator significantly interacts with the predictor variable and is not related to the dependent variable. A quasi moderator is one in which the moderator interacts significantly with the predictor variable and is related to the dependent variable.

identified two types of moderators: a pure moderator and a quasi moderator. A pure moderator is one in which the moderator significantly interact with the predictor variable and is not related to the dependent variable. A quasi moderator is one in which the moderator interacts significantly with the predictor variable and is related to the dependent variable. We utilised this framework in our data analysis to determine the nature of our moderator. The interaction approach is consistent with both contingency and contracting theory.

3. Research method

3.1. Sample and data collection

Data for the study were collected using a survey questionnaire from middle managers working in 11 business units operating in Finland. The number of people employed in each company was between 50 and 2000. Of the 11 companies, two are in the telecommunication industry, two in the construction industry, five in the metal industry, one in the electrical industry, and one in the chemical industry.

The research design involved two stages. The first stage was to have a meeting with a contact manager of each company to explain the purpose of the study, and why certain employee types needed to be selected for the study. The second stage was to distribute the questionnaire to the contact manager who in turn distributed them to the selected participants, who were managers involved in both revenue generating and cost incurring activities for their sub units. The participants were asked to complete and return the questionnaire to the researcher. Of the 124 managers selected for the study, 69 completed and returned the questionnaire, yielding a response rate of 64.5% at the time of the study. These managers were from sales (12%), finance (14%), business controllers (31%), project management (10%), production (14%), purchasing (4%), research and development (12%), and quality management (5%). On average, the respondents had been employed for 14 years, and had held their current position, on average, for four years.

To examine for response bias, the responses from the first 20% of returns and those from the last 20% were compared, to test if the responses differed between the two groups. Levels of significance were determined for each item using t tests. No differences were identified, which provided some support for the absence of a non-response bias. It is possible that the respondents' functional background may introduce bias. An examination of the mean responses between these groups for the variables listed in Table 2 did not reveal any significant differences.

3.2. Measurement of variables

Appendix A contains an abbreviated copy of the research questionnaire used to measure the reported variables in this study.

Performance. Managerial performance was measured through a self-evaluation on eight dimensions of performance identified by Mahoney et al. (1963): planning, investigating, coordinating, evaluating, supervising, staffing, negotiating and representing. An overall score[5] is calculated by averaging the eight sub-dimensions used as a measure

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[5] Most prior studies used the overall measure for performance as the dependent variable. We did not include this in our questionnaire. However, the high Cronbach's alpha (0.79) for the eight items suggests that this was appropriate. The construct validity of this measure was examined using factor analysis. A single item was extracted which accounted for 57% of the variance with all items achieving factor loading greater than 0.40.

Table 1
Factor loading for MAS instrument

Factor	*I*	*II*	*III*	*IV*	*V*
I. BROAGG (broad scope & aggregated)					
Non-economic information	**0.766**				
External information	**0.747**				
Different functions	**0.683**				
$\alpha = 0.78$					
II. FREQTIM (frequency of reporting)					
Frequency of reporting		**0.819**			
Speed of reporting		**0.641**			
$\alpha = 0.44$					
III. BROAGGINT (broad, aggregated & integrated)					
Non-financial			**0.744**		
What if analysis			**0.686**		
Precise target			**0.656**		
Cost/price information			**0.499**		
$\alpha = 0.76$					
IV. TIMAGG (speed and aggregated)					
Automatic receipt				**0.741**	
Immediate reporting				**0.713**	
Temporal reports				**0.416**	
$\alpha = 0.68$					
V. BROINT (broad & integrated)					
Future oriented					**0.722**
Organisational effects					**0.665**
Information other department					**0.568**
$\alpha = 0.61$					
Eigen values	3.46	2.27	1.47	1.27	1.09
% of variance	23.06	15.14	9.81	8.49	7.23

for managerial performance.

Perceived environmental uncertainty. The environmental uncertainty items are adapted from Miller and Friesen (1983). The respondents were asked to indicate the rate of change, from slow to rapid, at which products and services become obsolete, the rate of innovation in products/services and in process, and the rate of change in customers' taste and preferences. High numeric scores indicate higher rates of environmental uncertainty. The Cronbach alpha coefficient for PEU was 0.80, indicating satisfactory internal reliability for the scale (Nunnally, 1967). We adopted this version of PEU measurement because it was simple and short and covered most areas that managers are concerned with in terms of their environment (see Appendix 1).

MAS. A 15-item instrument adapted from Chenhall and Morris (1986) was used to measure management accounting system (see Appendix 1). Consistent with the procedure used by Chenhall and Morris, the MAS variables were randomised to reduce the possibility of managers repeating the same score for each question. In this study, the objective was to measure the extent of use of all the dimensions of MAS. Managers were asked to rate the 'extent of use' of MAS of both broad scope, integration, timeliness and aggregated information available from their organisation's MAS on a seven-point Likert type scale, ranging from 0 (not at all) to 6 (to a great extent). They were asked to consider the extent of use of this information in the context of their daily decision making activities. We used principal component analysis with varimax rotation to determine if all items measuring the MAS construct clustered together or not. Five factors with Eigen values greater than unity emerged from the principal component analysis, with solutions retaining 64% of the total variance of the data (see Table 1).

Following the rotation, the five constructs are Factors 1, 2, 3, 4 and 5 are denoted by the following information characteristics. The first category of MAS (BROAGG) is characterised by accounting information that is non-financial and less detailed. The second category (FREQTIM) is represented by frequency of reporting information. The third category of MAS (BROAGGINT) re-

Table 2
Descriptive statistics (n = 69)

	Mean	*Standard deviation*	*Observed range*	*Theoretical range*
Performance	5.70	1.15	2.63–8.13	1–9
BROAGG	3.01	1.16	0.33–6.00	0–6
FREQTIM	3.76	1.08	0.00–6.00	0–6
BROAGGINT	3.41	0.97	1.00–5.50	0–6
TIMAGG	3.43	1.10	1.00–6.00	0–6
BROINT	3.07	1.11	0.33–6.00	0–6
COMPMAS*	3.33	0.70	1.33–4.83	0–6
PEU	3.56	1.28	1.60–6.60	1–7

*Composite MAS

Table 3
Correlation matrix (Spearman rank)

Variable	*1*	*2*	*3*	*4*	*5*	*6*	*7*
1. PERF	1.00						
2. BROAGG	0.32**	1.00					
3. FREQTIM	0.03	0.19	1.00				
4. BROAGGINT	0.37**	0.45**	0.38**	1.00			
5. TIMAGG	0.02	0.20	0.03	0.11	1.00		
6. BROINT	0.12	0.29*	0.14	0.44**	0.18	1.00	
7. PEU	0.02	0.15	0.05	0.08	0.06	0.13	1.00

**Significant at the 0.01 level; * Significant at 0.05.

lates to information that is non-financial, less detailed and integrated. The fourth (TIMAGG) is characterised by information that is timely and less detailed, whereas the fifth (BROINT) denotes information that is future-oriented and integrated. In summary, we describe the variations of MAS in the first, third and fifth categories to have similarities with broad scope MASs as the information provided are non-financial and future-oriented. In contrast, the MAS in the second and fourth can be described in terms of frequency of reporting and level of integration. The argument here is that managers in some situations are likely to derive benefits from accounting information that is less detailed and non-financial, and issued in a timely manner. In some cases, information that is integrated, non-financial and less detailed is deemed to be important. The final scores were calculated by summing and averaging the raw scores. The Cronbach alpha coefficients are 0.78, 0.44 0.76, 0.68 and 0.61 for BROAGG, FREQTIM, BROAGGINT, TIMAGG, and BROINT, indicating the reliability of the measures. Table 2 presents descriptive statistics and Table 3 shows the bivariate correlation matrix for the variables used. We tested our hypotheses using the different variations of MASs generated by the factor analysis.

4. Analysis and results

Hypothesis 1

The hypothesis was tested using multiple regressions (Pedhazur, 1982) based on the following multiplicative model:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_1X_2 + e \qquad (1)$$

Where Y is managerial performance, X_1 is composite measure of MAS, or the five different variations of MAS generated by the factor analysis (BROAGG, FREQTIM, BROAGGINT, TIMAGG, and BROINT), and X_2 is perceived environmental uncertainty, and X_1X_2 is the interaction term, and e is the error term. Examination of the residuals from the regression equation suggested that there were no major violations of assumptions of normality. To support H1, the coefficient b_3 in the regression equation (1) should be significant ($b_3 \neq 0$) and positive. The results of the moderated regression analysis are contained in Table 4. The first of the results presented in Table 4 refers to the composite measure of MAS. The following four[6] regression

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[6] We did not include the regression model for FREQTIM since its reliability did not meet the cut-off point of 0.60 suggested by Nunally (1967). In addition, the interaction equation was not significant.

Table 4
Results of moderated regression analysis

	Coefficient	*Value*	*SE*	*T*	*p-value*
Constant	b_0	8.590	1.790	4.798	0.00
MAS (composite measure)	b_1	–0.874	0.537	–1.627	0.11
PEU	b_2	–1.447	0.515	–2.850	0.00
MAS*PEU	b_3	0.433	0.153	2.829	**0.00**
R^2=0.21; Adj R^2=0.17; F=5.75, P<0.01					
Constant	b_0	5.958	1.083	5.501	0.00
MAS (BROINT)	b_1	–0.101	0.344	–0.294	ns
PEU	b_2	–0.195	0.296	–0.659	ns
MAS*PEU	b_3	0.065	0.092	0.717	ns
R^2=0.02; Adj R^2=–0.02; F=0.514, P >0.10					
Constant	b_0	6.989	1.004	6.962	0.00
MAS (BROAGG)	b_1	–0.743	0.309	–2.407	0.02
PEU	b_2	–0.416	0.319	–1.305	0.19
MAS*PEU	b_3	0.237	0.096	2.461	**0.02**
R^2=0.18; Adj R^2=0.14; F=4.696, P<0.01					
Constant	b_0	9.139	1.279	7.147	0.00
MAS (TIMAGG)	b_1	–0.969	0.331	–2.933	0.00
PEU	b_2	–0.964	0.333	–2.893	0.00
MAS* PEU	b_3	0.274	0.087	3.145	**0.00**
R^2 =0.14; Adj R^2=0.10; F=3.586, P<0.02					
Constant	b_0	7.684	1.386	5.543	0.00
MAS (BROAGGINT)	b_1	–0.579	0.393	–1.475	0.15
PEU	b_2	–0.997	0.370	–2.693	0.01
MAS*PEU	b_3	0.286	0.104	2.760	**0.00**
R^2=0.23; Adj R^2=0.20; F=6.489; p < 0.001					

models refer individually to each of the four different variations of MAS. The results in Table 4 show that the composite MAS model has an adjusted *R* square of 17%, and that b_3 is positive and significant ($t = 2.829$, $p = 0.006$), indicating an interactive effect of PEU and sophisticated MAS information on performance. The foregoing MRA was replicated for each of the different variations of MASs. The results closely resemble the findings for the composite measure of MAS, with the exception of FREQTIM and BROINT. Our results support the argument of Bouwens and Abernethy (2000) and Gerdin (2005) that there is some potential overlap[7] between the dimensions of MAS. For example, broad scope and integrated dimension of MAS can be provided in a timely manner as well as in an aggregated format. In other words, some variations of MAS are more effective than others during high levels of PEU.

To find out whether a non-monotonic effect exists, the partial derivative of equation (1) over use of MAS information characteristics (X_1) was computed (Southwood, 1978; Schoonhoven, 1981). If $\delta y/\delta x_1$ is always positive and negative over the entire observed range of PEU (X_2), then the relationship between managerial performance (Y) and the use of MAS information (X_1) may be regarded as non-monotonic. Such relationships can be examined by calculating the 'inflection point' of the slope by equating the partial derivative calculated in equation (1) to zero (Southwood, 1978; Schoonhoven, 1981). The partial derivative of equation (1) with respect to X_1 is shown as follows:

$$\delta y/\delta x_1 = b_1 + b_3X_2 \qquad (2)$$

The partial derivation of equation (2) gives the following results for Hypothesis H1:

$$\delta y/\delta x_1 = -0.874 + 0.433X_2 \qquad (3)$$
(composite measure of MAS)

First, Equation 3 represents the interactive effect on managerial performance between composite

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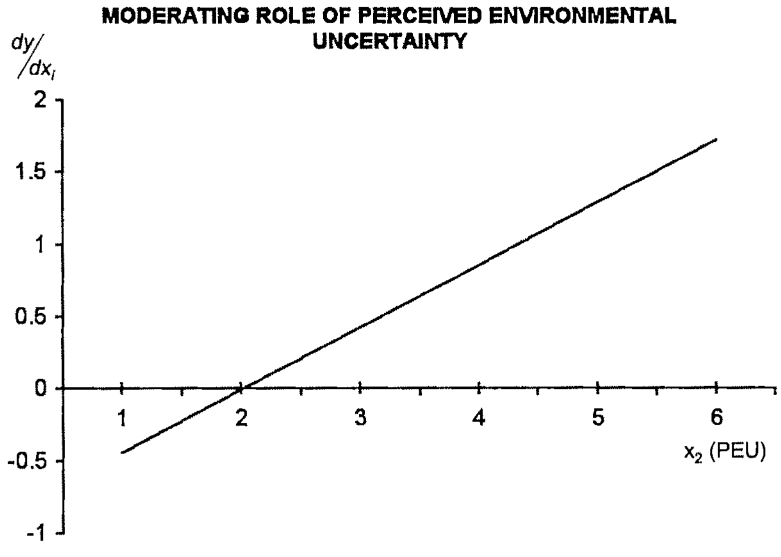
[7] We also tested the interaction of each dimension of MAS (timeliness, broad scope, integration, and aggregation) and PEU on performance. Only broad scope and aggregation showed a positive and significant interaction. This confirms our approach that managers that perceive their environment to be uncertain would use different variations of MAS to help reduce uncertainty and improve decisions, which, in turn, may improve managerial performance.

Figure 2
Relationship between composite measure of MAS (X_1), PEU (X_2), and performance (Y)



view of MAS and PEU. Figure 2 plots equation (3) using the regression coefficients from Table 3, and the observed range for PEU (of 1.60 to 6.60). The vertical axis represents $\delta y/\delta x_1$ and the horizontal axis the level of PEU. The graph shows that the effect of changes in MAS information on managerial performance is non-monotonic over the observed range of PEU, with a point of inflexion at a value of PEU of 2.02 (determined by setting the partial derivative of equation (3) to zero) lying within the observed range of PEU. Equation (3) will be zero, when X_2 (PEU) has a value of 2.02, which is the inflection point. In other words, equation (3) will be positive when PEU is above 2.02 and negative when PEU is below 2.02. Based on these results and analysis, hypothesis H1 is supported, indicating that there is an interaction between PEU and the composite measure of sophisticated MAS supporting the study of Gul (1991). Similarly, the other significant interactions showed a non-monotonic relationship.

To investigate further this aspect of the interaction, respondents were classified as belonging to either high or low use of MAS and high or low PEU groups (dichotomised at the median). Table 5 shows the mean performance scores for the two levels of use of sophisticated MAS information (composite measure) and PEU. The highest average performance score (6.36) is in Cell 4 (that is a high use of MAS high/high PEU cell), which means that a high use of sophisticated MAS information and high PEU combination is beneficial to performance, and this supports the hypothesis. Note that performance is lowest in Cell in 2, where PEU is high and the use of MAS is low. Similar results were obtained by Gul (1991). Statistical support for this conclusion is provided by ANOVA[8] and a post-hoc test using (Turkey-HSD) and is reported in Table 5.

5. Discussion, limitations and conclusions

The objective of this study was to examine the moderating role of PEU in MAS-performance relationship. The results support those of Gul (1991), and Gul and Chia (1994), and add to scarce empirical research in providing evidence of management beliefs that the use of MAS varies under different environmental conditions. Specifically, the results suggest that the higher the level of PEU, the more positive is the relationship

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[8] The result of the Levene test of homogeneity of variance is non-significant in Table 5 ($p > 0.05$), showing that there is no reason to believe that the variances of the four groups are different from another, which would violate the homogeneity of the variance assumption of ANOVA. Similar patterns were identified by the different variations of MAS that showed significant interaction.

Table 5
Mean performance scores across low/high PEU and low/high MAS

	Low use of MAS high information			*High use of MAS high information*
Low PEU	N = 16 $\bar{Y} = 5.562$ $\sigma_y = 0.942$	**Cell 1**	**Cell 2**	N = 18 $\bar{Y} = 5.680$ $\sigma_y = 1.143$
High PEU	N = 18 $\bar{Y} = 5.236$ $\sigma_y = 1.134$	**Cell 3**	**Cell 4**	N=17 $\bar{Y} = 6.363$ $\sigma_y = 0.1.144$

Analysis of variance

	df	*Sum of squares*	*Mean squares*	*F-ratio*	*P*
Between groups	3	12.457	4.15	3.48	0.02
Within groups	65	77.511	1.19		
Total	68	89.968			

Note: The results of ANOVA is F (3,3.48), $p < 0.02$. Post hoc Turkey-HSD test* significant at $p < 0.02$ show that, in terms of mean performance score for managers, managers in Cell 4 (that is high use of MAS information and high PEU) scored significantly higher (mean = 6.363) than the mean performance score for managers (5.236) in Cell 3 (low use of MAS and high PEU), and that no other differences were statistically significant.

*See Corston and Colman (2003) for discussion of this test.

between the use of MAS and performance. In addition, our study identified five variations of MAS dimensions: non-financial and aggregated, frequency of reporting, non-financial, aggregated and integrated, timely and aggregated, and non-financial and integrated. For example, broad scope MASs was significantly represented in the four variations of MAS dimensions and thus suggests that broad scope information that provides a wide range of qualitative and quantitative information, financial and non-financial, as well as ex-post and ex-ante information is vital for managers in decision making during the perceived environmental conditions, and is required in many different forms (Gordon and Narayanan, 1984; Ansari, 1997).

A number of directions for further research emerge from this study. For example, by developing a taxonomy of information types and identifying the impact of PEU on their transferability and importance, researchers can narrow the gap between research in MAS and research in economics. Further research could expand the model to include variables such as size, product customisation, and organisational structures such as layers and spans of control. For example, Vickery et al. (1999) found that product customisation promotes fewer layers for small and not large firms.

Some limitations are noted in the present study. First, participants of the eleven companies were selected for study by their representatives, and hence the sample was not strictly random. Consequently, some caution is necessary before generalising the results. Second, the regression model of performance explained a variance (adjusted R^2 = 17% for the composite MAS model) indicating that variables other than the use of MAS and PEU are at work in affecting performance. Potential variables include product customisation (Bouwens and Abernethy, 2000) and leadership style (Otley and Pierce, 1995). The use of a self-rating scale to measure managerial performance is likely to have higher means values (higher leniency errors) in the score (Prien and Liske, 1962; Thornton, 1968). Finally, our study suffers from the usual limitations associated with the questionnaire survey method (see Oppenheim, 1966). Despite the above limitations, our study, together with those of others (Chenhall and Morris, 1986; Gul, 1991; Gul and Chia, 1994), constitutes an attempt to systematically evaluate the role of perceived environmental uncertainty on the relationship between MAS and managerial performance and, as a result, improves the likelihood that MAS will help managers improve their performance and that of their organisations.

Appendix A

Perceived environmental uncertainty

Indicate the rate of change for the following (1 = very slow and 7= very rapid)

PEU 1: The rate at which products and services become outdated.
PEU 2: The rate at which marketing practices are changing.
PEU 3: The tastes and preferences of customers in your industry.
PEU 4: Actions of competitors.
PEU 5: The rate of change of product/service technology.

MAS Measurement

(Arranged in random order)

Broad scope:

1. Information that relates to possible future events (if historical information is most useful for your needs, mark the lower end of the scale).
2. Non-financial information that relates to production and market information such as growth share etc. (If you find that a financial is most useful for needs, please mark the lower end of the scale.)
3. Non-economic information, such as customer references, relations, attitudes of government and consumer bodies, competitive threat.
4. Information on broad factors external to your organisation, such as economic conditions, population growth, technological developments, etc.

Timeliness:

5. Requested information arrives immediately upon request.
6. Information supplied to you automatically upon its receipt into information systems or as soon as processing is completed.
7. There is no delay between an event occurring and the relevant information being reported to you.
8. Reports are provided frequently on a systematic, regular basis, e.g., daily reports, weekly reports.

Aggregation

9. Information in forms, which enable you to conduct what if analysis.
10. Information on the effects of events on particular time periods (e.g., monthly/quarterly/annual summaries, trends, comparisons, etc.
11. Information in formats suitable for input into decision models (such as: discounted cash flow analysis or incremental/marginal analysis).

Integration

12. Cost and price information of departments of your business unit.
13. Presence of precise targets for each activity performed in all sections within your department
14. Information that relates to the impact that your decisions have on the performance of other departments.
15. Information on the impact of your decisions through out your business unit, and the influence of other individual's decision on your area of responsibility.

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Accounting on the frontline: cost accounting, military efficiency and the South African War

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Abstract—The South African War (1899–1902) exposed significant defects in the administration of the British army which precipitated several parliamentary inquiries. The findings of these inquiries convinced the British Government that army administrators, but especially those responsible for supplying the army, had given insufficient attention to the military benefits which might be obtained from the methods and experience of business. The absence of cost accounting systems throughout the War Office and on the field of battle, resulting in problems for financial management and military efficiency, was given particular prominence by the War Office (Reconstitution) Committee (Esher Committee) and the Royal Commission on War Stores in South Africa. The paper broadens the compass of the debate about the evolution of cost accounting in the latter decades of the 19th and early 20th centuries by demonstrating how the advantages of cost accounting were clearly established and accepted by many senior civilian military administrators and politicians as a result of British experience during the South African War.

1. Introduction

Throughout the latter half of the 19th century, most British government spending was still for military purposes. Despite the unprecedented social reforms of this period, which saw the British Government assume increasing responsibility for the well-being of its citizens, the financial needs of the army and navy continued to dwarf all other government spending and even that of the largest British businesses (Watt, 1988:160; Mackinder, 1907:2; Sir Charles Harris in Hinchliffe, 1983:68). Thus, irrespective of the political importance of military establishments, the financial demands of the military were of necessity a prominent concern of all British governments. This was especially so in a political environment at various times dominated by either Gladstone's strict, parsimonious morality in public spending or the expansionist demands of empire in the latter decades of the 19th century.

Regardless of the extent of the financial burden of the army upon the nation, until the arrival of the 20th century there had been only spasmodic appreciation by British governments of the potential for accounting practices used in the management of large businesses to enhance military operations in the field. Rarely was it appreciated, beyond a few knowledgeable individuals in the Finance Department at the War Office, that cost information could be a potent tool for army administrators to organise and manage in the interests of improved military performance; that is, success in battle. This began to change when investigations of serious administrative failures during and immediately after the South African War (1899–1902) concluded that the contributions of accounting to successful military operations had been consistently and carelessly forsaken. This accusation took on some prominence in a war which one participant described as 'more essentially a supply and transport … (war) than any in which the British (or any other) Army has ever been engaged' ('Frugalitas', 1905:10). It took the exposure of the manifest shortcomings during the South African War of the Army Service Corps, upon whom the army depended for its essential supplies, for the government and army administrators to appreciate finally the relevance of accounting knowledge that went beyond the purely mechanical tasks of checking payments and completing a vast array of accounting returns on behalf of civilian financial overseers in the War Office. So important were the administrative reforms arising from the army's experiences in the South African War that it is generally regarded by military historians as a watershed in military administration[1] and the reason why the British army was so well prepared at the outbreak of World War I (Watt, 1988:156). Not until after the South African War was the British

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[1] Administration refers to those aspects of the army that are concerned with meeting the material and warlike needs of the army. These are sometimes referred to as the business or financial side of the army (see 'Colonel', 1914:71).

Government, through the reforms of Secretary of State for War Richard Haldane, prepared to permit the organic changes urged for half a century by the army and its supporters which were required to ensure that the army would be able to run its own affairs and do so efficiently.

Despite the financial and political prominence of the British army in the 19th century and early 20th century, there have only been the briefest incursions by accounting historians into the significance of the military experience in the recent history of government accounting (Black, 2001a,b; Funnell, 1990,1997; Hoskin et al., 1997). Accounting historians interested in military matters have tended to confine their examinations to developments in cost accounting at the British Ministry of Munitions, which had been created during World War I to coordinate the production of the implements of war (Loft, 1986; Marriner, 1994) and, in the United States, cost accounting practices developed at the Springfield armoury in the 19th century by graduates of the Westpoint military academy (Hoskin and Macve, 1988, 1994, 2000; Tyson, 1990). In the case of the Springfield armoury, Chandler (1977: 74) described their accounting systems as 'the most sophisticated used in any American industrial establishment before the 1840s'. Foreman and Tyson (1998:9,27) and Foreman (2001:40) have established that in Australia at the turn of the 20th century factories operated by the Department of Defence were the first public sector enterprises to use modern cost accounting practices borrowed from commercial firms.

Amid the extensive debates involving manufacturing for military purposes, and the influence of disciplinary regimes of military training, the application of accounting to the operations of the army in the field, the object of the manufacturing, has been substantially avoided by accounting historians. Black (2001a:94), also, has referred to the reticence of accounting historians to study accounting in government departments such as the army. This paper has been written to address this neglect with reference to the experiences of the British army in the South African War, which ushered in some of the most far-reaching and enduring changes in the history of British military administration, not the least of which was a salutary appreciation of the contribution of cost accounting to military success in battle. Subsequent reform of military administration was propelled by the findings of the War Office (Reconstitution) Committee (Esher Committee) in 1904, the Royal Commission Appointed to Inquire into the Military Preparations and Other Matters Connected With the War in South Africa (hereafter the Elgin Commission) also in 1904 and the Royal Commission on War Stores in South Africa (hereafter the War Stores Commission) in 1906. It is from the reports of these last two inquiries and that of the Committee on War Office Organisation (hereafter the Dawkins Committee) in 1901 that much of the material in the present paper is derived. The extensive reports and minutes of evidence of the Elgin and War Stores Commissions, which relate the detailed evidence provided by both military personnel who had served in South Africa and senior individuals in government and military administration, contain a rich store of historical material concerning military accounting practices before and during the war. Indeed, the value of the reports and the evidence upon which they are based derives largely from the ingenuous manner in which evidence was given.

The concerns of this paper follow work by Funnell (1990), who examined the scandalous administrative failures in the Crimean War (1854–6) which spawned numerous failed attempts to reform military administration over the next 50 years. The focus of the most important of these reforms was how best to manage in the interests of military preparedness the relationship between the military and the civilians who controlled military finances. Each attempt at administrative reform from the Crimean War to the reforms prompted by the recommendations of the Esher Committee in 1904, the importance of which Barnett (2000:359) believes 'can hardly be exaggerated', involved a progressive diminution of the place that civilians would occupy in military administration (for details of the reforms see Biddulph, 1904:1–14). At the outbreak of war in South Africa in 1899, military finance still remained firmly within civilian hands at the War Office, thereby denying the army the opportunity to gain in peace the experience with financial responsibility that they would need to manage large-scale modern wars efficiently and economically. The way in which the financial ignorance and impotence of the British army exaggerated the deficiencies in army accounting during the South African War, and the consequences of this for military success, are the subjects of this paper. Not only were most army administrators in the field of battle financial novices, they found themselves also bereft of experienced financial staff and reliable accounting systems which could provide the information that they desperately needed to ensure that they had at their command an army which was as efficient and economical as possible in the circumstances.

The remainder of the paper opens with an account of the events and institutions which traditionally determined the state of preparedness and standing of the British army. First to be established is the constitutional identity of the British army at the time of the South African War; that is, its constitutional relationship with parliament and the tensions that this created in army finances. The quality of the preparedness of armies for battle would always be determined by these ' practical politics' (Ormsby, 1908b: 1,533). Administrative failures of the British army during the South African War are then shown to have convinced British Governments of the insufficiency of policies, administrative structures and accounting systems developed for the conditions of peace which kept the army at war in a state of financial ignorance. Most importantly for this paper, the South African War awakened in government a keen appreciation of the importance to military success of well-developed, frequently rehearsed, habitual systems of cost accounting in the field. Although the British army was not a pioneer in the development of cost accounting techniques, its experiences unambiguously established that the management technologies of business also had an important role to play in government administration, particularly contributing towards military success.

2. 'Practical politics', accounting and military efficiency

2.1. The constitutional requirement of financial ignorance

No institutions were more important to the progress and safety of the British nation in the 19th century than the army and the navy ('B', 1899:64), neither were any departments of state more closely controlled. 'Practical politics' (War Office Cost Accounting Committee, 1918) demanded the supremacy of parliament, mostly through 'a ruthless and dominant Treasury ...', in all matters related to the granting of finance to the military and accounting for approved expenditures (Midleton, 1939:123; Funnell, 1990; Wright, 1969; Otley, 1970:213). These constitutional protections against military pretensions were inseparable. Soon after leaving office as Chancellor of the Exchequer, Lord Randolph Churchill confirmed that:

> '...the control of Parliament, the interference of Parliament,[2] the jealousy of Parliament for its rights and privileges, these are the arguments in favour of an adherence to the main lines of our present system of naval and military administration. (Royal Commission into the Civil and Professional Administration of the Navy and Military Departments, 1890: 15)

The control of military spending on behalf of parliament was given as a sacred trust to civilians to ensure the political security of the nation, for the army must never gain control of the nation's purse (*Contemporary Review*, December 1886:766; Barnett 2000; Constitutionalist, 1901:48; for criticisms of civilian involvement in army administration see Churchill, 1895:40).[3] Even in the late 19th century the actions of the military during the English Civil War (1642–1660) and the 'Glorious Revolution' (1688), which had imperilled the lives of citizens and denied them their liberty, were still not completely forgiven.

Army accounting, following Loft (1986:138), was political in itself. Its calculative practices and rationales, embedded in political processes, were 'linked to particular conceptions of government and ... (to) the appropriate mechanisms through which they ... (were) to be enacted' (Miller, 1990:316). Political rationalities and ideologies which were the product of centuries of constitutional evolution accorded 'significance and meaning to ... (the) quite mundane calculative routines' of government accounting (Miller, 1990:334; Loft, 1986:137). Indeed, the influential Esher Committee[4] (1904:137) found that:

> '...[T]he question of finance lies at the root of War Office administration. Upon the proper adjustment of responsibility between the spending and the accounting branches must depend alike the efficiency[5] of the military forces and the safeguarding of the interests of the taxpayers.' (see also Constitutionalist 1901:48)

On the eve of the South African War, ultimate authority in all matters military, whether administrative or command, resided with the Secretary of State for War as parliament's representative and the Financial Secretary at the War Office. As the highest public officer responsible for the army it was for the Secretary of State 'to know for what purpose they required an army, and to insist that the army should be efficient to fulfil that purpose' (Amery 1902:44; see also the Dawkins Committee, 1901:201; Secretary of State for War 1891:255). Throughout all the attempts at reform of the army between the Crimean War and the South African War, the Secretary of State for War retained undiminished the constitutional and practical control of army finances, and remained the parliamentary officer through which the army's accounts, prepared by the Finance Department at the War Office and audited by the Comptroller and Auditor General, were transmitted to parliament (see Sir Charles Trevelyan, Assistant Secretary at the Treasury, to the Duke of Newcastle, 1 March 1854, Trevelyan Papers CET 33; Hamer, 1970:40; Midleton, 1939:126).

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[2] Throughout this paper the word 'parliament' is written in the lower case except where the upper case is expressly used in borrowed material.

[3] Major Churchill (1895:40) of the Army Pay Department suggested that civilians were preferred for financial duties because they were better educated. In contrast, most army officers in the lower ranks had received a very limited education which unsuited them to a career in army finance.

[4] Lord Esher was a long-term confidant of Edward VII and a major influence in the Edwardian Court. He preferred his associations with the monarchy over those of Westminster (for example, see Searle, 1971:3). He had been secretary to the Hartington Commission in 1890. Campbell-Bannerman described the committee, consisting of Lord Esher, Admiral Fisher and Sir George Clarke, as 'strange' because none of the members was familiar with army administration (Wilson, 1973:217).

[5] The term military efficiency was used at the time to refer to military success in battle. An efficient army was an army which used its financial resources to achieve victory.

The Finance Department at the War Office had been established in 1870 as part of the administrative reforms of Lord Cardwell,[6] Secretary of State for War 1868–1874 (Gordon, 1935:57–68; Spiers, 1992:2). It was staffed entirely by civilians and administered by a senior civil servant, the Accountant-General who was answerable to the Financial Secretary, a junior member of parliament who in turn advised the Secretary of State for War on matters of military finance (*Quarterly Review*, vol. 129, July to October 1870:262; Howard 1978:19; *Edinburgh Review*, October 1900:272 and 1875:537; Biddulph, 1904:17,24). The Finance Department received and disbursed all sums payable and receivable on behalf of the army and supervised the army's accounts, including audit, according to Treasury regulations. In addition to control over cash, the Financial Secretary and his department were also charged with: review of expenditure proposed in annual estimates and the compilation of estimates; financial review of proposals for new expenditure; control of manufacturing departments of the army, and supervision of contracts through the Director of Army Contracts (Royal Commission into the Civil Establishments (hereafter the Ridley Commission) 1887, 'First Report': xxi; Order in Council, 21 November 1895, *British Parliamentary Papers*, 1899, vol. LIII: 538). The Financial Secretary was to be the main source of advice to the Secretary of State for War on all financial matters pertaining to the army, thereby placing him in a position to control the efficiency of the army and the economy of its administration (War Stores Commission, 1906, Minutes of Evidence, Question 499:27; Committee Appointed to Inquire into the Arrangements in Force for the Conduct of Business in the Army Departments (hereafter the Northbrook Committee), 1870, Third Report: xxi; Striedinger, 1909:202–203; for criticisms of the Financial Secretary see Churchill, 1903a:279). Ultimately, civilian control of military finances emanating from the Secretary of State for War also had the potential to have a significant impact on military success. There was no place in these arrangements, determined entirely by constitutional imperatives, for the army either to be an equal player or an authoritative contributor. The financial ignorance which this system of financial administration forced upon army administrators, army commanders in the field and army personnel responsible for supplying the army with its material needs, none of whom in South Africa had spent any time at the War Office or had been consulted by the War Office, was only too obvious in the South African War.

The military regularly complained that their exclusion from financial matters pertaining to the army's preparedness most often meant that demands for funds only rarely received the serious consideration that the army believed they deserved (Esher Committee, 1904:150). Soon after assuming the position of Commander in Chief of the army in 1895, Lord Wolseley referred to the tendency of civilians, either in government or in army administration, still to prefer the certainties and the easy economies of peace when planning for the army's material needs, the lessons of the Crimean War apparently long forgotten. At the same time, these civilians pick 'up some rudimentary notions of war ... to see how the supposed wants of war could be best provided for under conditions and establishments ... created for peace' (quoted in Maurice and Arthur, 1924:291; see also the Elgin Commission, 1904:128; Report of the Royal Commission on Warlike Stores, 1887: x; Ormsby, 1908b:1535; Mackinder, 1907:7). The result, according to the military, was that the civilians and the military tended to want to take the army in opposite directions.

Military complaints about insufficient funding during the 19th century were not unusual for the military. Victory, according to the military, was always threatened by parsimonious governments in peace which only released the purse strings when war had been declared. Even then, the bounty of war could not suddenly compensate for the suspicion and neglect of the army during peace which saw it unable to directly control its finances. To the nation the financial demands of soldiers had long been notoriously insatiable. No amount of money was ever enough to meet the ghosts of war conjured by the military: 'If you believe the doctors,' parodied Lord Salisbury at the turn of the 20th century, 'nothing is wholesome: if you believe the theologians, nothing is innocent: if you believe the soldiers, nothing is safe' (quoted in Huntington, 1972:66). In the early 19th century Pell warned that 'if you adopt the opinion of military men, naturally anxious for the complete security of every available point; naturally anxious to throw upon you the whole responsibility for loss in the event of war suddenly breaking out ... you would overwhelm this country with taxes in time of peace' (cited in Morely, 1903, vol.II:47).

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[6] The Cardwell reforms in 1870 had removed finally any lingering ambiguities that the army was answerable to parliament and not to the head of the executive government. Cardwell divided the War Office into three sections: the Commander-in-Chief, who was responsible for military personnel; the Surveyor-General of Ordnance, who provided the military's material needs, and Finance.

While governments, wary of military demands and growing militarism on the Continent, resisted extravagant military spending during the long periods of relative calm enjoyed in the latter half of the 19th century, the growing obligations of an invigorated empire meant that military spending climbed steadily throughout the latter decades of the century. Military spending received a significant boost after the early 1880s from the staunch imperialist Lord Salisbury when prime minister (1886–92, 1895–1902), much to the disgust of Gladstone and Lord Randolph Churchill who resigned as Chancellor of the Exchequer in protest at Salisbury's refusal to reduce military spending in 1887 (Churchill, 1906 vol.II:230,235,239). Military spending was constrained, however, by both the unpopularity of income taxation, which remained below 8d in the pound throughout the latter half of the 19th century (Mitchell, 1988:645), and the unprecedented demands on government finances arising from widespread social and economic reform (Semmel, 1960).

Despite this, between 1880 and 1898 when expenditure on social programs, including public works, education, law and education, increased 40%, from £16.9m to £23.4m, the expenditure for military purposes increased 75% from £25.2m to £44.1m (Mitchell, 1988:588–9; Esher Committee, 1904:131; Hoppen, 1998:113). Ultimately the extreme demands of war meant that even this level of funding was insufficient to ensure victory in South Africa when funding rapidly increased from £44.1m in 1898 to £123.3m in 1902. Thus, problems with military performance during the war could not be explained by the military being starved of funding. Rather, the committees and commissions of inquiry unleashed by military inadequacies in South Africa argued that the reasons were to be found in the system of military administration which the constitution had demanded, but which isolated the military from control of its finances. While ever the government's primary motive in its relations with the army was to ensure that it did not present a political threat, governments did not really understand the systems of financial administration and accounting that were needed to ensure success until the tragedies of war exposed the embedded deficiencies.

In practice, disdain for the ability of the army to manage itself and the demands of 'practical politics' meant that until the first decade of the 20th century military administration was centralised within the numerous, civilian-controlled departments at the War Office, from which emanated a plethora of regulations to cover every conceivable situation but which only served to engender confusion and delay (Wright, 1956:464; Amery, 1903:158). The Esher Committee (1904:131) complained about the army being 'tied and bound in the coils of excessively complex and minute regulations drawn up without regard to the essential requirements of modern war ...'. Ralph Knox, Accountant-General at the War Office, complained to the Ridley Commission in 1887 (First Report, Question 3068:205) that 'Treasury control is increasing every day, and I cannot say that I think that it has been any advantage to the public service, rather the reverse ... [W]e have been driven into excessive expenditure by over-regulation' (for similar conclusions see the Esher Committee, 1904:137). Sir Redvers Buller, whose reputation was to be ruined by the South African War (see Fortescue, 1931, vol.I; Melville, 1923), scathingly castigated the:

> '...whole system of reports and regulations and warrants under which the British Army now serves ... [for it] has grown up entirely for the benefit of War Office clerks and to find work at the War Office rather than to find control for the Army... [They] do not like to let go out of their hands any power derived from the constant tying-up of Generals more and more by regulation. The result of their making those regulations in such detail is that unless they follow out that practice they have nothing to do.' (Committee to Consider Decentralisation of War Office Business (hereafter the Brodrick Committee, 1898, Minutes of Evidence, Question 950:194)

The Brodrick Committee in 1898 was unforgiving in its criticism of the suspicious paternalism of army administrators and of the Accountant-General in particular. There was no prospect of improvement, assured the Brodrick Committee, when the accounting systems in place stipulated that commanding officers in peace had to apply to the War Office for permission to pay funeral costs which were more than £2 and where clothing repairs exceeded 3s.6d. (Brodrick Committee, 1898:130). Under these circumstances, pleaded the Brodrick Committee, it would be 'preferable to face the certainty of occasional mistakes, rather than by a machine-like system of this character, to deny the sense of responsibility and check all inducement to economy'. Indeed, the inability of army administrators to control their own finances in peace prevented them from either wanting to assume or being able to assume financial responsibility, thereby suppressing any initiative, the consequences of which in war were entirely predictable to the military, namely 'the collapse of the officer trained for many years to be frightened to death of a sixpence when he is suddenly called upon to decide on a matter in which thousands of pounds may be involved' (Field Marshall Hamilton, *Commonwealth Parliamentary Papers* vol. II, 1914:149–150; Lawrence Committee, 1924:715; Esher Committee, 1904, part 2, p.9 of the Final Report; Dawkins Committee 1901:182; Hamer 1970:187; Tulloch 1901:500; Adye 1891:292). To the army financial authority in military hands and military victory were coterminous.

The financial impotence of the army was compounded by the constitutional requirement that the army account to parliament for its spending solely and rigidly on the basis of the divisions or heads in the army estimates by which parliament appropriated monies for military uses[7] (see the *1846 Audit Act*, Sections II, VI; *1866 Audit Act*, Sections 23, 24; Evidence of Sir Richard Hamilton before the Ridley Commission 1887, Appendix: 425). This forced army administration and accounting to be organised according to constitutional conventions of accountability, to allow spending to be easily traced rather than organised in a manner which would best promote military efficiency (Lawrence Committee, 1924:718; *Regulations for the Commissariat and Transport Staff*, 1881, Section 1, subsection III, paras. 46–48; War Office Cost Accounting Committee, 1918:4). The primary aim was financial accountability according to the narrowest of legalistic stewardship intentions, including a concern for economy. Government accounting systems had never been designed with the intention to promote military effectiveness.

2.2. *Cost accounts and military efficiency*

The constitutional intent of the appropriation accounts forced upon army accounting an exclusive concern for the 'subjects' of expenditure, for example salaries, instead of 'objects' or specific purposes to be achieved, for example the cost of maintaining a battalion or a field hospital (Select Committee on National Expenditure, 1918, Minutes of Evidence, Sir Charles Harris, also Seventh Report: 157,163; see also Grimwood, 1919:114; Public Accounts Committee, 1924–5, Appendix 30B, *Memorandum by the Accounting Officer, War Office*: 814; War Office Cost Accounting Committee, 1918:3). As a result of this accounting myopia and enforced exclusivity, Colonel Keane and Major Churchill of the Army Pay Corps, when later reflecting upon a system the intention of which had changed little during their time in the Corps, 'dismissed army accounts as valueless for control; of no use for ensuring efficient and economic administration' (Grimwood 1919, Concluding Address; Churchill, 1895:38; Funnell, 1997). Sir Raph Knox, at one time the Accountant-General at the War Office[8] appreciated that:

> '...[a]ccounts formulated on an 'object' basis had the ability to tease out and analyse departmental functions, results and costs; something not possible nor sought under the traditional 'subject' mode of appropriation accounting'. (Select Committee on Army and Navy Expenditure, 1887, First Report, Evidence of Sir Ralph Knox, Questions 34 and 1134; Harris, 1911:64; Crosland, 1918:8)

Sir Charles Harris, reflecting upon 'thirty years' experience of the actual working of the present system of external control of War Office expenditure, in peace and war', and army accounting expert Lieutenant Churchill insisted in their evidence before the Select Committee on National Expenditure in 1918 (see especially Harris's evidence on p.391 of the Committee's Report) that the army's accounting system had long been a constitutional anachronism which would continue to subvert attempts to give the army greater autonomy from civilian financial control and, crucially, to jeopardise the certainty of victory in modern wars (Report of the Select Committee on National Expenditure, 1918:391; Harris, 1911:65, 67; Harris, 1931:314; Brodrick Committee, 1898, Questions 484–487:21; Churchill, 1895:36; Ormsby, 1908a:836; Public Accounts Committee, 1917–18). They appreciated that for the military embroiled in deadly combat far from their civilian masters in the War Office the importance of reliable accounting systems in ensuring the best possible use of scarce resources could become a matter of life and death (see also Amery, 1909:618; Ormsby, 1908a:836,841; Amery, 1903:171). The Lawrence Committee (1924, para. 5 of the report) later confirmed that without 'a proper system of accounting it is impossible to obtain the best and most economical administration results', upon which victory might depend. Accounts that merely checked ledgers and vouchers were worthless (Young, 1906:1,284). Yet these silences in army accounts were entirely consistent with the very narrow range of visibilities permitted by the cash-based appropriation accounting meant to serve constitutional, not management, purposes

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[7] At the beginning of the 20th century parliament approved army estimates under 15 headings or votes. The annual Appropriation Acts gave the Exchequer the authorisation to issue money to the War Office. The Comptroller and Auditor-General had officers permanently stationed at the War Office to audit army accounts. As in all departments of state, the War Office was required to have an office to certify that all expenditure was made according to parliamentary approvals. This function in the War Office was performed by the Accountant-General. His close association with the Treasury to which he was ultimately accountable, however, meant that he could not avoid having divided loyalties.

[8] Knox retired in April 1901. Knox has been described as a 'brilliant man unable to bear fools gladly' (Wilson, 1973: 53).

(Loft, 1986:140; Ormsby, 1908b:1533).

Sir Charles Harris[9] was firmly convinced that modern commercial accounting systems, in which cost accounting might be accorded a place of some prominence, offered the best means to enhance military success by promoting economy and efficiency in military spending, rather than by using detailed and numerous regulations emanating from the War Office to govern every procedure for the sake of procedure (Harris, 1911; *The Balance*,[10] (2), Spring 1924). According to Harris, cost accounts 'should become the main channel of administration and the main channel of parliamentary control' (Select Committee on National Expenditure, 1918, Minutes of Evidence, Question 220 and 248: 334–6; Harris, 1911). Convincing parliamentarians of the viability of Harris's hypothesised dual function of cost accounting was later to be a major impediment to the acceptance of cost accounting in government departments at the time of the army's cost accounting experiment between 1919 and 1925 (Ormsby, 1908b:1,535; Public Accounts Committee, 1917–18; Public Accounts Committee, 1924–5). The British Government's experiences with armaments manufacturers during World War I would seem to indicate that Harris's appreciation of the benefits of cost accounting for the army, expressed both before and after World War I (see for example Harris, 1911), was well ahead of that generally pertaining to government and many businesses. Loft (1986:146,148) describes most manufacturers at the outbreak of World War I as ignorant of the cost of their products. Indeed, according to *The Accountant* (1 March 1919:150) many manufacturers at the outbreak of war would have regarded the need for cost accounts as 'ridiculous'.[11] One contributor to *The Accountant* in 1900 (30 June: 600) complained that it was 'surprising how many manufacturers pay little attention' to cost accounts while the *Journal of Accounting* in 1909 referred to cost accounting being in a 'formative state' (Lybrand, 1909:234). During World War I Dicksee (1915b:19) also criticised senior business managers for being 'quite ignorant of the uses that accounts might have ...'.

Captain Young (1906) of the Indian Ordnance Department advocated the adoption of a system of responsibility accounting based upon cost accounts for the entire army. He argued that if economy of operation were to be made the concern of individuals in the army, then accounts would have to identify the cost of operations under each individual's control. These accounts, suggested a senior army officer much later when cost accounts had yet to be adopted by the military, would enable:

> '...responsibility to be delegated to those subordinates who know the details and who alone can adjust them to actual requirements. By means of the account you can allow a free hand and judge by results. The delegation of power which ... accounting makes possible develops those invaluable human qualities of enterprise and resource.' (Sir John Keane quoted in Grimwood, 1919:158)

Information collected by the accounting system advocated by Captain Young could then be used as a form of standard costing to compare the performance of other parts of the army in similar circumstances and also to compare performance across time, the beginnings of a system of management accounting (Young, 1906:1,282–3). 'Surely,' concludes Young (1906:1,283), publication of this information 'would effect more real economy than any number of rules and regulations'. Accounts which exposed and reported the costs of activities, he insisted, were to be regarded as important for their contribution to military efficiency; that is success, not as ends in themselves which seemed to be the nature of the army accounting required by the financial regulations under which the army laboured (Young, 1906:1,284). In this way the cost accounts advocated by Young and Harris would also serve to reassure the nation, from which the army gained its financial sustenance, that its taxes were not being recklessly squandered. This had concerned Charles Fox (1749–1806) who, in the late 18th century, warned parliament that 'to pledge a man's honour is not the most honourable mode of accounting .... I have no intention of disputing the point of honour, but I want to know what you have done with the money' (quoted in Constitutionalist, 1901:59).

Although both Harris and Young may have been justified in their appreciation of the *potential* benefits of cost accounting, or accounting based upon an object basis, Harris was well aware that the new system that he enthusiastically advocated could not be superimposed upon the existing structure of the army's administration (Harris, 1911). This, as established above, was entirely derived from the need to provide constitutional protections against the military. The centralisation of financial administration in civilian hands that this demanded would have to be replaced by a devolved system of financial administration if cost accounting was both able to be implemented and able to deliver the benefits professed in its favour. Funnell (forthcoming) shows that when the opportunity was provided for the army to implement a limited form of cost accounting the essential fundamental reform required to the organising principles and motives of military accounting, away from those which were derived from constitutional needs to the principles of business efficiency, were ultimately too much to expect of the government and the Treasury.

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[9] After coming first in the civil service competitive examinations, in 1887 Harris had been appointed as a clerk at the War Office, where he remained until 1924 when he became Joint Secretary of the War Office. Early in his civil service career, Harris had been auditor of factory accounts for Ordnance Factories, rising to Assistant Financial Secretary at the War Office in 1908 and membership of the War Council in 1920. Haldane (1929:186) described him as a 'very remarkable man' who was 'profoundly convinced' that there was great waste in the army.

[10] The journal of the Corps of Military Accountants, 1923–5.

[11] Hoskin and Macve (2000: 98) take a less extreme view than that expressed by *The Accountant*, suggesting that accounting information was used by many businesses for the purposes of controlling costs and for making operational decisions.

The existing constitutionally-based system of accounting, the essential function of which was to allow parliament to monitor executive spending according to parliamentary approvals, was the honed product of more than three hundred years of constitutional practice. According to the Treasury (see comments by Sir Charles Harris, Public Accounts Committee, 1924–5, Question 6708), cost accounting could not hope to provide a similar level of constitutional assurance. The Secretary of State for War, Sir Herbert Creedy, when expressing his opposition to the continuance of the cost accounting experiment before the Public Accounts Committee in 1924 expressed his concern to the Public Accounts Committee that to move to the new system of cost accounting in preference to existing systems of accounting would require the entire reorganisation of all levels of army administration, from the War Office down, which were presently organised on a 'subject basis', and the attendant costs and dislocations that this would involve. Such an undertaking, he believed, 'could only be carried out if there were very, very great and assured advantages, both in efficiency and cost, and I was not satisfied that either of those advantages was inevitable' (Public Accounts Committee, 1924–5, Minutes of Evidence, Questions 6839,6884,6887).

The inability of army accounts to provide information about the cost of specific aspects of its operations, such as the cost of running training manoeuvres, not only betrayed long-standing constitutional concerns but also the tension between the positive rationalities of accounting and those of a military culture based upon qualitative characteristics in which matters of finance traditionally had little significance. Honour, duty, tradition and valour defined the priorities of military men and upon these traits their behaviour would ultimately be judged by superiors and peers. Rarely was their ability as good accountants and financial managers deemed to be significant under the system of civilian financial control pertaining at the onset of war in South Africa in 1899. It seemed a contradiction to expect the military in the heat of battle to act as good managers and consider the financial consequences of their actions, for victory above all else was the expectation, irrespective of the financial cost (Ormsby, 1908a:841; Amery, 1903:159–60). 'On active service,' reminded Amery (1909:407), 'economy is not the supreme test; the supply officer must feed the troops in the face of every difficulty, irrespective of cost.' Unavoidable cost arising from efficiently administering to the needs of the army *in extremis*, however, was something very different from financial burdens arising from the incompetence, ignorance and poor organisation which were shown to have characterised the South African War. Military success, reminded Captain Ormsby (1908a:841), lay 'in the inculcation of the principles of economy and finance in the combatant officer'.

3. The South African War (1899–1902)

The South African War, also known as the Boer War, was the culmination of over two centuries of expansion in the south of Africa by Afrikaners, the Dutch settlers who arrived with the Dutch East India Company in 1652 at the Cape of Good Hope. In 1806 during the Napoleonic Wars, Britain took the opportunity to take possession of Dutch coastal settlements at the Cape and imposed its will on a large and resentful Boer population. When Britain outlawed slavery in 1834, the Boers took their black servants and began their 'Great Trek' inland across the Orange and Vaal rivers, establishing the Transvaal and Orange Free State which were subsequently recognised by the British between 1852–4 (de Wet, 1902; Iwan-Muller, 1902). However, over the next two decades the British became increasingly unsettled by the growing political stridency of the Boer states, culminating in 1877 with the peremptory annexation of the Transvaal by the British, which was meant to be the prelude to the creation of a federated British South Africa. After a Boer revolt in 1881 the independence of the Transvaal was reinstated (Elgin Commission, 1904:12; Kruger, 1959:7), the apparent political calm soon to be disturbed by the discovery of gold in the Transvaal in 1886.

Gold attracted large numbers of British citizens, known as Uitlanders, whom Boer authorities, fearing that they would be politically overwhelmed, refused to give equal political rights (Pakenham, 1979: xxi–xxii, 66). Not surprisingly, British dignity and its mission to civilise the world[12] demanded that the Uitlanders not be abandoned

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[12] George Curzon, later the Marquis Curzon of Kedleston, believed that Great Britain 'was the greatest Instrument for good the world had seen' (quoted in Pearl, 1967: v).

(Porter 1980:58; Headlam, 1933, vol. II: 561; Kruger 1959:30). Lord Milner,[13] the British governor of South Africa, believed that the only way that the British were going to induce the Boers to capitulate to the demands of the Uitlanders was with the threat of force (Pakenham, 1979:64; see Milner's urgent and pressing telegrams to Prime Minister Chamberlain on 30 and 31 August 1899 in Headlam, 1931, vol. I: 499). When agreement could not be reached at a meeting in May 1899 between Milner and President Kruger of the Transvaal (Headlam, 1933, vol.II: 3; Porter, 1980:214) the outbreak of war followed in October (see also Amery, 1902:1; for a list of the British demands presented at Bloemfontein see Headlam, 1931, vol. I: 526; Spiers, 1992:312). Pakenham (1979: xv) has described the resulting South African War as the longest, costliest and, with 22,000 British and 25,000 Boer dead, the bloodiest war for Britain from 1815–1914.

Although the British army was ultimately victorious, the humiliations that it suffered in the early stages of the war at the hands of ill-disciplined farmers before a 'gloating world' (Spiers, 1992:309; for an appreciation of the Boers' fighting abilities see Haldane, 1929:137) awoke a complacent nation (Barnett, 2000:353; Searle, 1971:34; Churchill, 1959:56,70,72). This culminated in the appointment of the Elgin Commission in 1904, the findings of which Amery (1904:154) thought would 'appal even the most optimistic'. These findings were soon to be confirmed by the War Stores Commission in 1906. Despite the many warnings of impending hostilities during the long lead up to the outbreak of war, 'improvisation, afterthought and strategical blundering ... characterised the conduct of the war' (Amery, 1902:1 and 1904:162,164; Midleton,[14] 1939:138; Editor, 1905:417; Field Officer, 1902:271). The British army was forced to confront the Boers with shortages in almost all forms of warlike stores and supplies[15] (see the Elgin Commission, 1904, Appendix 33:218–40 for details of supply preparations; Richardson, 1903; Fortescue, 1930:243). Also, although the War Office in the late 19th century planned to have 100,000 fully equipped troops for overseas service, the best that they could manage by the close of 1899 was 50,000 (Pakenham, 1979:251; Symons,1963:100–1).[16] This would eventually swell to more than 400,000 troops by the cessation of hostilities on 1 June 1902.

For the politicians the fault was all the army's. Even before war had been declared Chamberlain believed that his government would be let down badly by the War Office. In a letter to Milner a month before the Boer ultimatum, Chamberlain decried the way in which the War Office had assured him that 'they were ready 'to the last button' – now they talk of four months before they can put an army corps to the front' (Chamberlain to Milner, 2 August 1899, in Headlam, 1931, vol. I: 525; Wilson, 1973:164). Chamberlain's appreciation of army administration was to be confirmed by the strident criticisms of the Esher Committee in 1904 (p.10) and, in almost exact terms at the cessation of hostilities, by the then Secretary of State for War for whom the South African War:

> '...made it abundantly clear that the Army in its present form is not suited ... (to) war .... The Army, such as it is, is not fully and scientifically organized for war; whereas the sole of object of an army ... is to be able to engage in war at the shortest notice ... we have been maintaining an army in peace time a large portion of which was totally unfit for war ...' (Elgin Commission, 1904:311; Esher Committee, 1904:10; see also comments by Hamer, 1970:174 and also Churchill, 1903:281)

Early deficiencies in preparedness were compounded by the absence of any forethought by the Finance Department at the War Office to assist officers in the field with the financial complexities now forced upon them and for which they had been allowed little preparation (Hinchliffe, 1983:45). This left the army vulnerable to criticisms of incompetent management and irresponsible stewardship of public monies, which had not only led to needless extravagance but also had permitted numerous frauds to occur at significant cost to the public purse (see for example Haldane, 1929:137,185).

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[13] Milner had been appointed by Lord Lansdowne, the Secretary of State for War between June 1895 and November 1900. Richard Haldane (1929:136) described Milner as 'a man of most attractive qualities but was difficult to work with'.

[14] The Earl of Midleton, previously St. John Brodrick, was Secretary of State for War from 1900–02.

[15] In military usage stores refers to armaments, ammunitions and any items necessary for engaging in battle. The term supplies was used by the military to indicate anything needed to feed troops and other consumables necessary to care for them and their mounts (Elgin Committee, 1904, Minutes of Evidence, vol. I, question 8: 2; Amery, 1909:365). For an inventory of the supplies available at the outset of war see Amery, 1909: 452.

[16] The army's predicament was also aggravated by the rivalry that existed between the soldiers at the War Office who had served in India, represented by Lord Roberts, and those who had mainly served in Africa, lead by General Wolseley (Pakenham, 1979:71; Searle, 1971:43). Milner, whose jingoistic opposition to the Boers precipitated a declaration of war, was scathing in his appreciation of the British army: '...the *central machinery* and the *chosen leaders* ...– was there ever such a series of misselection?' (Milner to Lord Selbourne, 31 January 1900, quoted in Headlam, 1933, vol. II: 61, emphasis in the original).

4. The role of accounting in the micromanagement of war

4.1. Accounting in the field and the accountant-general's department

Whereas during peace the paternalistic presence of the War Office was obvious in most administrative decisions, throughout the South African War senior commanders were cast adrift by the War Office to manage as best they could, despite the financial and organisational complexities that were 'thrust' upon them on the frontline of war (Elgin Commission, 1904, Minutes of Evidence, Question 5847:130). Notably, the Accountant-General had made no special arrangements prior to the war to ensure that generals in the field had access to financial advice and that the accounting systems in place in peace would be appropriate for the conditions of a major military conflagration. Accountant-General Sir Frank Marzials,[17] who admitted to the War Stores Commission that the South African War was unlike anything experienced for 50 years (1906, Minutes of Evidence, Question 580:31; Amery, 1909:612; see also Spiers, 1992: Appendix 2), had not realised the difficulties that his office would face in a protracted war thousands of miles from Britain. Not surprisingly, the Dawkins Committee (1901:189) was highly critical of the Accountant-General's inaction, lamenting the lost opportunities for improved financial management that the appointment of representatives of the Accountant-General to military divisions would have provided. Although the former Secretary of State for War, St. John Brodrick, assured the War Stores Commission (1906, Minutes of Evidence, Question 11:2) that he had been dissatisfied with the financial advice available to officers in the field of battle, little if anything was done to improve the situation.[18]

According to the War Stores Commission, the absence of representatives of the Accountant-General's office had jeopardised the prospect of a decisive victory, contributed unnecessarily to the pressures under which the generals operated and to the 'unreasonable' cost of the war, estimated by the Accountant-General to be in excess of £201m (Elgin Commission, 1904, Appendix 50:336–9; Spiers, 1992:312; for the importance of financial advice in ensuring economy see also the Public Accounts Committee 1924-5, Minutes of Evidence, Questions 6709,6711 and Ormsby, 1908a:842, 1908b:1534). The Esher Committee (1904:139) also saved its most scathing comments about the army's financial preparedness and accounting systems for the Accountant-General's incompetence and that of his staff. The Committee criticised the clerks in the Accountant-General's office, few if any of whom were trained accountants, who checked that all army expenditure had been made according to War Office and Treasury regulations for being too prone to interfere from London in the military actions of officers commanding troops in the field. So overbearing were these intrusions, most of which were matters of pettifogging clarifications about spending authorisations for amounts recorded in the accounts, that they were 'intolerable, and they *fully* account for the administrative inefficiency of the War Office' (Esher Committee 1904:139, emphasis added). According to the Esher Committee (1904:137), the civilians in the Accountant-General's Department (formed in 1855) at the War Office were 'promiscuous' in their auditing, accounting and contract making, for the War Office's financial system was:

> '...based upon the assumption that all military officers are necessarily spendthrifts and that their actions must be controlled in gross and in detail by civilians ... This theory is largely responsible for the unreadiness for war which has been exhibited, as well as for reckless and wasteful expenditure ... The department of the Accountant-General has become a huge and costly machine which is supposed to control expenditure by the aid of involved regulations which serve to aggrandize its power over the military branches.'

As a result of the oppressive way in which the Accountant-General's office mechanically enforced 'cumbrous' financial safeguards on behalf of parliament, 'the whole army', lamented Amery (1902:141):

> '...spent the greater part of its existence in checking its accounts ... (E)very item of daily accounts was checked and rechecked and copied out in duplicate and triplicate. ... *It was accountancy run mad.* The object of it all was to prevent defalcations. The object was obtained but at a ruinous cost.' (emphasis added, see also

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[17] Sir Frank Marzials was Accountant-General from August 1888 to May 1904.

[18] The strength of the Commission's criticisms of Marzial and his office and the unambiguous directedness of the criticisms towards Marzial as Accountant-General and other senior officers, both military and civilian, indicates that the inquiries were not cynical political exercises which sought to direct blame from senior administrators. Each of the senior civilian and military administrative officers were brought before the various inquiries and made to give an account of their behaviour. Reading the minutes of evidence, one is struck by the relentless way in which the commissioners pursued those before them, irrespective of rank. The insistent questioning of senior army and War Office personnel indicates that the sympathy of the War Stores Commission lay with the ranks and junior officers of the Army Service Corps and the Army Pay Corps who had been left in a vulnerable position by the neglect of the Accountant-General and other senior officers. The recommendations of the inquiries reflected this with their concern for systems rather than individuals except where, as in the case of Marzials, the individual was in a position to know better and to take their responsibilities seriously.

the War Office Cost Accounting Committee, 1918:2)

In defence of his department, the Secretary of State for War claimed that any problems with the performance of the Accountant-General's office did not arise from want of conscientious application. Rather, the clerks in the Accountant-General's office were so overworked in superintending regulations that some of them had died from their exertions and others had lost their reason (War Stores Commission, 1904, Minutes of Evidence, Question 13:3). Irrespective of their apparent zeal, the Esher Committee, however, came to the conclusion that 'no branch of the War Office more urgently needs radical reform than that of the Accountant-General' (Esher Committee, 1904:138).

In light of the level of operational ignorance and inactivity displayed by the Accountant-General, the War Stores Commission was intrigued by General Kitchener's decision to appoint a financial adviser to his staff. Kitchener, who had a notorious reputation for economy and a concern for the taxpayer (Magnus, 1958:217), had realised early after his arrival in South Africa in January 1900 that he would need the assistance of a skilled finance officer located in South Africa who would take responsibility for managing the complexities of the military's finances. Most importantly, Kitchener needed someone to oversee the contracting arrangements with firms in South Africa that supplied the army with most of its consumables. When the Army Pay Corps was unable to provide someone suitably qualified for this new position, Kitchener was offered the services of Guy Fleetwood Wilson (Ormsby, 1908a:846; Hinchliffe, 1983:45), the Assistant Under-Secretary of State for War.[19] Fleetwood Wilson's appointment was the first time that a general commanding in the field had been able to have expert financial advice readily available. Fleetwood Wilson (1922:114) saw his duty to 'insist on a shilling being sufficient when it could be made to produce the same result as half-a-crown... I was constantly employed in pricking bubbles and pointing out weak spots in military 'adventures' ...' Towards the end of his time in South Africa Fleetwood Wilson assured Kitchener that if

> '...a Financial Adviser had been appointed at the beginning ... he could have prevented excessive charges from arising, instead of merely curtailing them when large ... He could have established a system of watching and controlling expenditure .... He could probably have arranged that supply accounting was conducted along defensible lines.' (Elgin Commission, 1904:128; see similar comments by Amery, 1909:621)

Fleetwood Wilson left South Africa soon after Kitchener in June 1902, to be replaced by Major Armstrong from the War Office who found himself in a very different position to that enjoyed by Fleetwood Wilson. Whereas the latter was given a senior appointment on Kitchener's staff with attendant authority, Armstrong and the financial assistance that he was able to provide, were no longer acceptable to Kitchener's successors who forced Armstrong's repatriation to England on the grounds that his rank exceeded the requirements of the position. Armstrong was eventually replaced by a more junior officer 'who had absolutely no knowledge of markets or of the difficult work of dealing with South African contractors' (War Stores Commission, 1906:9). The presence of a financial adviser in their headquarters, even one with a military rank, was alien to the generals in South Africa. Neither their training nor the War Office had allowed them to appreciate the military contributions of a resident financial officer. To expect that they, unlike Kitchener, would change in the ferment of war the habits of a lifetime of soldiering was unrealistic. The inaction of the Finance Department in stopping Armstrong's removal also reflected the 'absence of inter-communication, of common action or of common interest between the various departments of the War Office' (War Stores Commission, 1906:8). This, criticised the War Stores Commission, exposed the British Government to very significant costs in the months immediately following the war as the army sought to dispose of large stocks of supplies. The commissioners believed that if a specialist financial adviser and his staff had been present much of the fraudulent activity discovered subsequently could have been avoided (see below). Military commanders who were fully occupied with the pressing demands of engaging with the enemy would be unlikely to be also finance and business experts (Ormsby, 1908a:841 and 1908b:1534). They needed financial advisors so that they would be in a position to judge the extent to which financial considerations might affect the prospect of victory.

4.2. The army pay corps and accounting for cash

Normally the day-to-day interpretation and application of War Office financial and accounting regulations during war would be referred to the Army Pay Corps,[20] created in 1882 as the Quarter-master General's representative in the field (Elgin Commission, 1904:131; Churchill, 1895:45; Hinchliffe, 1983:1). The scale and complexity of the operations that confronted Kitchener when he arrived in Capetown on 11 January 1900, however, required sophisticated financial and accounting abilities well beyond the routinised, regulation-obsessed expertise of the Army Pay Corps. The Army Pay Corps, upon whom the Accountant-General as the army's accounting officer[21] was dependent but over whose military personnel he had no control,[22] had no financial advisory responsibilities nor the necessary experience in peace which would have allowed them to provide these services to the General Officer Commanding (GOC) in times of war. Their function was to complete in a mechanical fashion on behalf of the army any accounting returns prescribed by the Treasury, most of which involved accounting for soldiers' pay and stoppages and the safekeeping of cash (for details see Redway, 1902; Ormsby, 1908b:1538). Often these duties meant that paymasters were responsible for large sums of money but without the responsibility of superintending the way in which the money was used. From his dealings with the Army Pay Corps, General Kitchener believed that their 'purely clerical and mechanical' labours meant that they carried out their duties 'without any idea either of improvement or economy … (ignoring) financial considerations of any kind' (Elgin Commission, 1904, Minutes of Evidence, Question 218:130–1). So circumscribed were their duties that they had 'really no accounting to do at all, except a purely cash account; (they) pay out money, …(and) get a voucher for it' (Public Accounts Committee 1924–5, Minutes of Evidence, Question 6716; Churchill, 1895:37; for a discussion of the work of the Army Pay Corps in India see Black, 2001b).

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[19] Fleetwood Wilson had entered the civil service in 1870, thereafter serving as private secretary to four cabinet ministers. He then held the position of Director of the Royal Army Clothing Department, moving to the War Office as Assistant Under Secretary of State in March 1898 from which he was appointed to Kitchener's staff in October 1900 (War Stores Commission, 1906, Minutes of Evidence, Question 382: 22, also see Appendix 49: 305 for details of his appointment by Kitchener; Wilson, 1973: 175; Fleetwood Wilson, 1922).

The accounting work of the Army Pay Corps was significantly complicated during the South African War when often it became impossible to obtain the vouchers which had authorised expenditures and which were essential to make the necessary accounting entries. Accordingly, their systems of accounting broke down completely (Amery, 1902 vol.I: 461). The widespread ignorance amongst army officers about War Office accounting procedures made the Army Pay Corps' task even more uncertain. Army accounting systems in South Africa, but most importantly those needed for the crucial task of accounting for stores, could not cope with the turmoil and unpredictability of war, resulting in accounting information which was so incomplete as to be unreliable for any decision making purposes. Amery (1909:461–2) described accounting in the field 'resolving itself into utter chaos …, ludicrous ….(and) hopelessly inadequate in war'. It was not that there was a shortage of accounting going on but rather that there were too many meaningless accounting regulations which overwhelmed combatant officers (see Ellison,[23] 1918:4). James in 1901 (p.711) referred to the British Officer as 'a return-making animal' and as 'an overworked accountant' which, according to Sir Garnet Wolsey, prevented officers from carrying out their military duties (Hinchliffe, 1983:38).

The 'nonsense' which masqueraded as accurate accounts, urged the Public Accounts Committee, could only be remedied with the appointment to all wartime forces of a body of expert officials who understood how to keep military accounts (Public Accounts Committee, 1902, Fourth Report: 21, 22, 26, for similar comments see the Public Accounts Committee, 1903, Third Report: 17). Unfortunately, confirmed the Public Accounts Committee, 'no such supply of officers now exists, and that their absence has been the main cause of the imperfect control of expenditure in South Africa' (Public Accounts Committee, 1902, Fourth Report: 21). As a consequence of dissatisfaction with the performance of the Army Pay Corps in the South African War, both it and the Accountant-General's Department were replaced in 1905 with the Army Accounts Department (Ormsby, 1908a:843; Hinchliffe, 1983:49). Army Pay Department and Army Pay Corps officers and other ranks were forced to join the new department, each retaining his military rank, where they were mostly under civilian control. Ultimately, the Army Accounts Department, which was disbanded in 1910, was to be staffed entirely by civilians. In addition to the pay functions previously the responsibility of the Army Pay Corps, the new department also audited local military accounts and, drawing upon Kitchener's innovation, were to act as financial advisers (Amery, 1909:620).

4.3. Accounting for stores

Complementing the accounting duties of the

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[20] As part of the Cardwell army reforms, in 1878 all army officers who were Army Paymasters became part of the Army Pay Department while their non-commissioned officers were formed into the Army Pay Corps four years later (Hinchliffe, 1983:1). Throughout this paper reference will be to the Army Pay Corps.

[21] The 'accounting officer' was usually the head of a government department who was responsible for providing to parliament the annual appropriation accounts, through the Comptroller and Auditor-General.

[22] The Accountant-General was required to conduct an audit of the Army Pay Corps accounts to establish that they were carrying out their duties according to regulations. Army Pay Corps personnel were responsible to the Accountant-General for their accounts but were under the ultimate command of the military.

[23] Lieut. Co. Ellison had been the Secretary to the Esher Committee and Military Private Secretary to Haldane when Secretary of State for War. Haldane (1929:184), who was greatly impressed by Ellison's vast knowledge of the military, believed that the Esher Committee's report owed a great deal to Ellison (for a similar appreciation of Ellison's abilities see Amery, 1953: 206).

Army Pay Corps were those of the Army Service Corps, which since 1888 had been responsible for supplying the troops in the field with their food, forage and some stores (War Stores Commission, 1906, Minutes of Evidence, Question 558:3; Amery, 1909:366,369; 'Frugalitas', 1905:10). Unlike the Army Pay Corps, which was entrusted with accounting for cash, the Army Service Corps was responsible for accounting for the receipt and issue of stores and supplies. Irrespective of the great number of detailed forms and regulations which determined the work of the Army Service Corps, the War Stores Commission (1906:64) discovered that their accounts, like those of the Army Pay Corps, consisted of an 'inchoate mass of data' which needed to be extensively reworked before any sense could be made of their contents. So mismanaged was accounting by the Army Service Corps in South Africa that the Elgin Commission (1904:118) concluded that 'the Supply Branch was sent out without any organisation ...' When it was realised that the 4,000 Army Service Corps officers and men were insufficient to meet the demands of the war, large numbers of businessmen and accounting clerks had to be recruited in South Africa. Even with these additional resources the task of accurately accounting for and managing stores was generally beyond the capabilities of the Army Service Corps (Elgin Commission, 1904, Minutes of Evidence, Question 18329: 118; Fortescue, 1930:234,265). Fortunately for the British army, unlike their forebears in the Crimean War, they were engaged in battle in a country where food, forage and most necessities of life were to be found in abundance. This, the Elgin Commission believed, had fortuitously compensated for the inexperience, ineptitude, poor training and commercial naivety of the Army Service Corps.

5. Commercial naivety, cost accounting and the war stores scandal

Army Service Corps officers in South Africa were put in the invidious position of being forced to make decisions on matters about which they had no training in peace. In particular, in peace they were excluded from, and kept ignorant of, most aspects of contracting and the disposal of excess stores. During times of peace prior to the South African War all army contracts were arranged by the office of the civilian Director of Army Contracts at the War Office. Immediately at the outbreak of war, however, contracting with local suppliers in the first instance was to become the responsibility of the Army Service Corps, with the approval of the local commanding officer. Subsequently, all supply arrangements concluded in the field by the Army Service Corps were to be submitted to the Director of Army Contracts in London for evaluation, although not approval given the imperatives of time. A similar situation pertained to ammunition, weapons and medical supplies. Acquisition of all these ordnance stores in peace, including medical supplies, was the responsibility of the Director of Army Contracts and in war the Director General of Ordnance, both of whom were located in the War Office in London (Dawkins Committee, 1901:192; Fortescue, 1930:252). In peace, ordnance officers were not authorised to spend more than £25 without receiving prior approval from the Director of Army Contracts, neither was there any training in purchasing large quantities of stores on commercial markets. Similarly, an officer of the Army Pay Department stationed in England during peace was required to send all claims for amounts over £100 to the War Office. On an overseas posting, however, there was no need to seek War Office approval, *irrespective of the amount.* While serving in the South African War, Lieut. Col. Churchill was able to pay out, on his own initiative on a regular basis, amounts as large as £160,000, 'showing how on active service all the ridiculous instructions of the War Office have to be set on one side' (Churchill, 1903a:281).

Despite the vast array of new responsibilities imposed during war on the Army Pay Corps, the Army Service Corps and ordnance officers and the state of commercial ignorance in which they were kept in times of peace, during the South African War there were no representatives of the Director of Army Contracts in the field. Consequently, the Elgin Commission (1904:129) was not surprised to learn that throughout the war that there was 'serious mismanagement of ordnance business and a waste of public money'. Yet it was not to be unexpected, warned the Esher Committee (1904:138), that a financial system in which officers in peace were not given any financial responsibility would be anything other than 'futile in peace ... (and) ruinous in war'. The anomalous, contradictory expectations of supply officers in peace and war, suggested the Dawkins Committee (1901:193), was symptomatic of the general state of commercial innocence and confusion in which the office of the Director of Army Contracts carried out its duties. This confusion was to be a major preoccupation of the War Stores Commission (1906:54) which, among its strident criticisms of the Accountant-General and the Director of Army Contracts, reflected upon how the Director and his assistants were ignorant of even the basics of commercial contracting; so much so that they fell short of the knowledge which could be expected of even the 'average layman'.[24] After the declaration of peace, when it came time to dispose of surplus stores, the contractual inexperience of the Army Service Corps, the absence of any system of cost accounting for stores and their isolation from the Director of Army Contracts left them especially vulnerable and exposed to the commercial chicanery of local contractors in South Africa.

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[24] The commercial naivety of those responsible for army contracting so concerned the Dawkins Committee (1901:691) that they sought the advice of several prominent businesses about how contracts and purchasing should be managed. The businesses which provided advice were Armstrong, Whitworth and Co., Midland Railway, L.& N.W. Railway, Vickers, Rylands and Sons, Great Northern Railway and the Co-op Wholesale Society.

At the cessation of hostilities, large quantities of stores and supplies of all types were scattered in various depots throughout the battle area. In addition, considerable quantities of stores and supplies were in the process of being shipped to South Africa. Even though Kitchener had realised in early 1901 that the end of fighting was near, he did not want to signal to the Boers that the British effort was waning by cancelling existing contracts. This meant that stores were still arriving as troop numbers were rapidly declining. Rather than use the stores on hand to meet the needs of troops remaining in South Africa, before he left South Africa Kitchener decided that all stores would be sold and ongoing requirements then met from local purchases rather than by contracts made by the Director of Army Contracts in England. This, he believed, would avoid the costly necessity of retaining the services of a large body of Army Service Corps troops to guard and manage the supplies and reduce other costs associated with the storage of very substantial quantities of stores (War Stores Commission, 1906, Minutes of Evidence, Question 100:11). Unfortunately, even though the Army Service Corps never before had been entrusted with the task of selling supplies on the scale required in South Africa, the Accountant-General at the War Office issued no instructions to cover the new responsibilities (War Stores Commission, 1906, Report: 6,55 and Minutes of Evidence, Question 143: 14). Accordingly, on the recommendation of Colonel Morgan of the Army Service Corps, Kitchener created a special Sales Department headed by Colonel Morgan, which operated from June 1902 until towards the end of October 1902 with the express purpose of arranging the sale of all remaining stores and supplies. These operations of this new department within the Army Service Corps were the particular object of the wrath of the War Stores Commission.

Prompted by the evidence disclosed during the audit of army accounts by the Comptroller and Auditor General, the War Stores Commission uncovered a litany of errors, ignorance and mismanagement in dealing with army stores. These had permitted repeated and sustained instances of fraudulent activities, the cost to the nation which in the absence of any systematic cost accounting records the Commission was only able to make the roughest estimate. Without too much difficulty, the War Stores Commission 'established a degree of neglect of the public interest well-nigh incredible ...' widely referred to at the time as the war stores scandal (Amery, 1909:616; 'B' 1907:665; Searle, 1971:38). Thus, according to the Commissioners the Army Service Corps had failed miserably in its first test since its formation in 1888 (for a contrary view see Crew, 1970:101–2, Young, 2000:5 and Fortescue, 1930:229–65). The public, informed Lord Haldane, the new Secretary of State for War in 1906[25] (*Tribune* 29 October 1906), was:

> '...quivering with excitement over the spectacle of a great mass of very important work badly done to the detriment of the national purse. ... (There) has been the revelation in South Africa of an altogether inadequate organisation and training to cope with the business of supply in time of war, and the disorganized period which follows upon war. Supply is one of the most difficult things anyone can tackle ... (It) is a science in itself which requires high training.'

While few Army Service Corps officers were found to have engaged directly in fraudulent activities, professional ignorance of even the most basic aspects of commercial accounting and business practices was found by the War Stores Commission to be endemic to the Army Service Corps. This, believed the Commissioners, was due both to the personal failings of individual Army Service Corps officers and to their training which gave them little knowledge of business principles and cost accounting, thereby leaving them at the mercy of sharp businessmen who knew only too well the deceptive ways of business ('B,' 1907:667). Their peacetime training had prepared them to act as 'a mere accountant, an intermediary between the troops and various contractors, coming but rarely into contact with business men ...' ('B', 1907:668). Most of the peacetime training of the Army Service Corps was heavily military. It was devoted to military dressage, shooting and riding with only the most minimal attention given to the commercial and technical skills upon which the success of the Army Service Corps depended in war ('B', 1907:668). So widespread, unnecessary and obvious were the failures of the Army Service Corps to detect supply malversations that the War Stores Commission characterised the Army Service Corps as conducting its business:

> '...with inexcusable carelessness and extraordinary ineptitude, and that of the Pay Department with a want of intelligence that is deplorable ...We consider that ... (they) have not properly appreciated that it was their duty to protect the public and to act as trustees of the money which they were dispensing ... (T)he faults of their ad-

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[25] Haldane (1856–1928) was Secretary of State for War between 1905–12 (see *Dictionary of National Biography*, vol. 1,922–30: 380–6).

> ministration … spring mainly from … irresponsibility, indifference, and want of intelligence …' (War Stores Commission 1906:58)

According to one knowledgeable critic, the Army Service Corps was composed of men who were devoid of all business abilities and who brought with them neither business nor trade experience ('B', 1907:666). Recruits, many of whom 'B' alleges were the worst of their regiments, were attracted by the higher pay offered by the Army Service Corps and the prospect of an easy life away from the routines of military regiments ('B', 1907; for similar criticisms of the Army Pay Corps see Redway, 1902). Thus, the Army Service Corps was alleged to be the home of the undersirable, the indolent and the craven with the result that its activities were widely regarded by its members with 'contempt' and as a side show to the real activity of fighting. They had exchanged a career in military regiments which had an honourable standing for one 'which appealed neither to their zeal nor to their pride' ('B', 1907:666; Young, 2000:3; for a contrary and very one-sided view see Fortescue, 1930).

The problems exposed by the War Stores Commission were dramatically exacerbated, indeed the commission believed that they were permitted and actively encouraged, by the absence of any cost accounts, either in the field or at the War Office. The War Store Commissioners were dismayed to find that throughout all the store accounts kept by the Army Service Corps and those kept by the Accountant-General at the War Office, nowhere was there to be found together a record of the prices paid and the quantities of stores to allow the Army Service Corps to calculate the cost of the stores consumed by the army in Army Service Corps warehouses (War Stores Commission, 1906:3,64 and Minutes of Evidence vol. I, Question 504: 27; War Office Cost Accounting Committee, 1918:3). Lists of prices were to be found only at the War Office. Not only were Army Service Corps officers unaware of the cost of the items in their charge but, possibly more worrying still for the War Stores Commission, their training was such that they were not even aware that they should have this information before committing their government when contracting with local suppliers. This deficiency, suggested the War Stores Commission, should have been obvious, if at no other time, when prices were finalised for the disposal of surplus army stores. If a system of cost accounting had been maintained at the War Office on behalf of combatant officers and supply officers, the War Stores Commission believed 'knowledge of that fact would have proved a very valuable deterrent on both improvidence and peculation in South Africa' (War Stores Commission, 1906:64).[26]

The disarray found in the Army Service Corps accounts compelled the War Stores Commission to employ the services of chartered accountant firms to assist them in untangling the confusion. Deloitte, Dever, Griffiths, Annan and Coy were engaged in Johannesburg and in London Annan, Kirby, Dexter and Coy. Despite the large establishment of staff employed by the Accountant-General at the War Office and by the Army Pay Corps and the Army Service Corps in South Africa, the Commissioners could not rely upon the accounting knowledge of these officers nor had they any confidence of their appreciation of commercial accounting practices. According to Deloitte, Dever, Griffiths, Annan and Coy, whose experiences of army accounting were eerily similar to those of the Royal Commission into the Supplies of the British Army in the Crimea in 1856 (*British Parliamentary Papers*, vol. XX, including Appendix: 497), the Army Service Corps store accounts provided little if any useful information and precluded the possibility of conducting an audit that would produce anything of value, especially when belatedly conducted two years after the end of the war. So confused were the store accounts that there was no means 'by which the Secretary of State could ascertain, *even approximately*, how the supplies had been disposed of, or the quantities or costs of what had been lost from deficiencies … and the condition of purchases and sales' (War Stores Commission, 1906:3, italics in the original).

Fundamental structural deficiencies in the accounts were compounded by the business naivety of the Army Service Corps who were no match for the business sagacity of experienced, wily businessmen able to manipulate the inexperience and docility of the Army Service Corps to their own considerable advantage. The War Stores Commissioners were astonished at how the Army Service Corps had entered into contracts with local merchants which committed the army to selling stores at low prices to local contractors and, on many occasions, at the same time buying back at extravagantly higher prices precisely the same items, which may not have left the army's storehouses, from the same contractors to whom they had been sold (War Stores Commission, 1906:59). In one instance, examined in some detail on behalf of the War Stores Commission by Deloitte, Dever, Griffiths, Annan and Coy, one contractor, Meyer and Co., purchased 22,557,916lbs of surplus oats in December 1902 at a price of 11s per 100lbs. The same oats, without being removed from the Army Service Corps storehouses, were then purchased from Meyer at 17s 10d per 100lbs (War Stores Commission, 1906, Minutes of Evidence vol. I,

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[26] For a detailed account of stores accounting see the Elgin Commission, 1904: 324, Appendix 49.

Question 102: 11 and p.6 of the Report). The chartered accountants employed by the War Stores Commission estimated that on one such similar transaction alone Meyer had made a profit of £69,264 (War Stores Commission, 1906, Report of Deloitte, Dever, Griffiths, Annan and Co., Appendix: 81).

Buyers were supposed to remove from Army Service Corps stores everything that they purchased. However, in most cases of reciprocal dealings where the same items were being purchased from the army and then re-supplied to the army, the contractor found it easier to convince the Army Service Corps to arrange a system of offsets in their accounts, thereby saving the contractor the trouble and cost of warehousing stores. All that was involved on the part of the Army Service Corps was a simple book entry without the inconvenience and costs of removing stores; costs that the contractor was meant to bear instead of the army. If the stores sold to the contractor exceeded those purchased, the contractor would then be given a refund. However, in most cases when a refund was given the War Stores Commission found that the contractor sought a refund for stores left with the Army Service Corps which had deteriorated to the point where they were no longer saleable. Among the firms engaged in this practice the actions of the largest contractor, Meyer and Co., were deemed by the War Stores Commission to be amongst the worst.[27] Irrespective of the extent of Meyer's fraudulent activity and that of his dupes in the Army Service Corps, Meyer was of interest primarily to identify defects in systems of accounting and control which allowed the practices to occur. The recommendations of the inquiries reflected this concern for systems rather than individuals.

Meyer was also implicated in the practice whereby, as a result of the chaotic state of stores accounts at the end of the war, which left the army with far more goods on hand than was revealed in the accounts, dishonest non-commissioned officers (NCOs) in the Army Service Corps would offer for sale to contractors these hidden surplus stores at greatly reduced prices. Often these surpluses were purchased at half their market and contracted price, the payments going directly to Meyer's informants in the Army Service Corps. In the largest such transaction Meyer purchased 600,000lbs of oats. As a result of the inchoate state of the store accounts, the Commission's chartered accountants in London found it 'impossible' to obtain a reliable estimate of the total amounts involved in the frauds (War Stores Commission, 1906:61,81–82). Measured against the performance expected of private sector businesses engaged in similar buying and selling activities, the performance of the Army Service Corps had been pitiful. Indeed, according to the War Stores Commission (1906:58):

> '...[no] private firm could avoid bankruptcy if it allowed its agents to deal with business matters in the mode in which the Office of the Director of Supplies dealt with the purchase and sale of supplies. The Army Service Corps is, in fact, a commercial undertaking, and its officers should be taught to recognise that it must be conducted on business principles and should be trained to act on them also.'

The findings of the War Stores Commission and its admiration for the achievements and methods of the private sector, recognised by its reliance upon the investigations of chartered accountants and the opinions frequently solicited from successful businesses, proved instrumental in convincing Lord Haldane, then Secretary of State for War, to expose military administrators more fully to the methods of business (see Haldane in the *Tribune*, 29 October 1906). Indeed, the South African War and the attendant report of the Esher Committee marked the point at which the business side of army administration assumed considerably more importance (see for example McGuire, 1918:27). Attempts at systemic reform of military accounting by the introduction of cost accounting would have to wait until after World War I. With the extensive evidence before him, Haldane was only too aware that without knowledge of the customs of private contractors with whom the army spent many millions of pounds, and in the absence of expertise with sophisticated cost accounting systems in the field with which to manage, the Army Service Corps would never be a match for astute and often unscrupulous businessmen (Amery, 1909:407; Airey, 1913:466).

6. Conclusion

This paper has sought to broaden the compass of the debate about the evolution of cost accounting in the latter decades of the 19th and early 20th centuries by demonstrating how the advantages of cost accounting were clearly established and accepted by many senior civilian military administrators and politicians as a result of British experience during the South African War. Although the stimulus to the development of business accounting which has ensued from economic crises in the early 20th century is well known in the accounting literature (Gallhofer and Haslam, 1991; Armstrong, 1987:419), the impact of political crises on the evolution of accounting in departments of state is still insufficiently appreciated by accounting historians. Notably, this was not the concern of Loft's (1986) examination of the impact of World War I on the professionalisation of cost accounting outside government departments. Appreciation of the benefits of cost accounts by military administrators anticipated both demands by the British Ministry of Munitions during World War I that munitions contractors maintain accurate cost accounts and the use of cost accounts by many, if not most, British manufacturers.

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[27] After arriving in South Africa in September 1898, Meyer acted during the war as the agent of the South African Cold Storage Company and then the Imperial Cold Storage Company. In these capacities he had daily contact for two years with Col. Morgan, who was subsequently authorised by Kitchener to organize the sale of surplus stores. Meyer left the Imperial Storage Company in August 1902 to set up his own business which was successful in gaining a large share of the contracts to purchase surplus army stores and to supply the army with stores. The Royal Commission on War Stores in South Africa was very uneasy with the close association between Meyer and Col. Morgan, who would have a significant say in the awarding of the contracts, especially when it was revealed that Col. Morgan's brother Frank was recruited by Meyer on the recommendation of Col. Morgan at the then very generous salary of £1,200. Subsequently, Frank Morgan was dismissed as soon as his brother was recalled to England (Royal Commission on War Stores in South Africa, 1906: 14–15).

It was convincingly demonstrated to the British Government during the South African War that the goals of economy and military efficiency were incompatible with a very rigid, centralised and civilian-controlled finance function, the concern of which was subjects of expenditure instead of objects or purposes. Although this had been appreciated well before the South African War by senior civilian officials in the Finance Department in the War Office, most notably Sir Charles Harris and Accountant-General Sir Ralph Knox, this paper has shown that cost accounts were entirely absent in military and administrative branches of the army at the time of the war. Indeed, in the departments at the War Office which administered the largest business in Britain, that is the army (Watt, 1988:160; Mackinder, 1907:2), it was rare at the end of the 19th century to find an appreciation of the relevance and the benefits which might be obtained in the field of battle from the most basic cost accounting practices. This reluctance by departments of state to adopt cost accounting were entirely political and institutional, unlike the slow progress of cost accounting in business throughout the late 19th century which has been attributed to economic imperatives, a tendency to treat cost accounting procedures as trade secrets or because cost accounting did not appear to provide any commercial advantages (Armstrong 1987, p.419).

While economic motivations were not entirely absent in the decision to experiment with the introduction of cost accounting in the early 20th century in departments of state, these were always secondary in the initial stages to motives of national interest and constitutional proprieties. The potential contribution of cost accounting to improved economy in the army was certainly recognised as a benefit to commend cost accounting. However, this had never been sufficient of itself to convince the British Government that cost accounting was either necessary or constitutionally appropriate. Instead, the potency of economic arguments for the adoption of cost accounting by the British Government in the decades spanning the close of the 19th century was entirely dependent upon circumstances providing sufficient political justification, in the form of military crises, and also the necessary assurance that there would be no threat to the constitutional protections provided by appropriation accounting. Neither the executive nor parliament was convinced that cost accounting systems would not dilute the constitutional protections of the existing system of appropriation accounting. The dictates of a rigid interpretation of the constitutional function of government accounting would continue to preclude serious consideration of cost accounting for the army and other government departments until after World War I, and even then the engagement would be only fleeting (War Office Cost Accounting Committee, 1918). Even after the findings of the War Stores Commission and the Royal Commission Appointed to Inquire into the Military Preparations and Other Matters Connected with the War in South Africa (Elgin Commission) had convinced many in government of the financial and military benefits of management-orientated control systems, constitutional imperatives still prevailed.

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The effect of audit committee shareholding, financial expertise and size on interim financial disclosures

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Abstract—In recent years, corporate failures and accounting irregularities have led to concerns about the effectiveness of audit committees in the financial reporting process. In response, corporate governance committees in different countries have made specific recommendations designed to enhance the role of the audit committee in executing its financial reporting oversight duties. We investigate in this study, the effect of some of these recommendations by empirically examining the relationship between selected audit committee characteristics and the level of disclosure in interim reports of a sample of 262 UK listed companies. Specifically, the audit committee characteristics examined are shareholding of audit committee members (as a proxy for audit committee independence), audit committee size and audit committee financial expertise. Employing both a weighted and unweighted index to measure interim disclosure, the results indicate a significant negative association between shareholding of audit committee members and interim disclosure. Our results provide evidence of a significant positive association between interim disclosure and audit committee financial expertise. We find no significant relationship between audit committee size and the extent of disclosure in interim reports. Overall, however, our results suggest that audit committee characteristics have an impact on its monitoring effectiveness of the financial reporting process. These results have important implications for corporate governance policy-makers who have a responsibility to prescribe appropriate corporate governance structures to ensure that shareholders are protected.

1. Introduction

The corporate scandals of the 1980s and 1990s[1] were followed by a series of committees of inquiry into the financial aspects of corporate governance in most developed countries. Examples of such committees include, among others, the Treadway Commission (1987) in the US, the Cadbury Committee (1992) in the UK, the Vienot Report (1995) in France, and the Peters Report (1997) in the Netherlands. The consensus view of these committees is that the credibility of the financial reporting process is dependent upon specific corporate governance control mechanisms, such as non-executive directors, board subcommittees (e.g., audit committee), auditors and institutional shareholders. The most recent corporate governance committees, such as the Blue Ribbon Committee (BRC, 1999) in the US, and the Higgs Report (2003) and the Smith Committee (2003) in the UK, continue to emphasise the importance of such corporate governance control mechanisms. For example, the Higgs Report (2003) makes recommendations designed to make non-executive directors more effective in the corporate governance process. Both the BRC (1999) and the Smith Committee (2003) direct their attention to the importance of the audit committee in the financial reporting process. They make recommendations designed to make the audit committee more effective in its oversight of the financial reporting process.

In the context of the above, the effectiveness of different corporate governance control mechanisms on financial reporting has been the subject of empirical research. For example, studies have examined the effect of a number of corporate governance variables (e.g., board size, proportion of non-executive directors, presence of audit committees, role duality, institutional shareholders) on

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[1] In the UK, some of the well-publicised high-profile corporate scandals during this period include, among others, Maxwell, Polly Peck, BCCI and Guinness.

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corporate disclosures (e.g., Forker, 1992; Ho and Wong, 2001; Haniffa and Cooke, 2002; Eng and Mak, 2003). A number of other studies have specifically examined the effect of audit committees on financial reporting issues by examining, for example, fraudulent financial reporting (Beasley, 1996; Dechow et al., 1996; Abbott et al., 2000; Peasnell et al., 2001), earnings management (Klein, 2002; Bedard et al., 2004), and auditor dismissal (Carcello and Neal, 2003). Collectively, these studies support the assertion that corporate governance control mechanisms influence the quality of financial reporting. However, the studies have tended to concentrate on annual reporting. No identified empirical research, internationally, has been conducted on the effect of corporate governance control mechanisms on other publicly available price-sensitive reports, such as interim reports and press releases, despite their increasing importance to stock market participants. Further, while in the US, studies have investigated the impact of audit committee characteristics on financial reporting (e.g., Abbott et al., 2000; DeZoort and Salterio, 2001; McDaniel et al., 2002), in the UK, prior research has tended to investigate the effect of the presence of the audit committee (e.g., Forker, 1992; Peasnell et al., 2001). However, given the differences in corporate governance systems between the US and the UK (Short and Keasey, 1999), the results may be different in the two countries, and hence the need for research based on UK data.

The main purpose of our study is, therefore, to empirically examine the relationship between the level of disclosure in interim reports of UK listed companies and selected audit committee characteristics (shareholding of audit committee members, audit committee financial expertise and audit committee size). A study of the relationship between disclosure in interim reports and audit committee characteristics is important in understanding the role of the audit committee in the financial reporting process. Both the Cadbury Committee (1992) and the Smith Committee (2003) recommend that audit committees should also review interim disclosures. Additionally, the BRC (1999) claims that audit committee involvement in the interim financial reporting process should result in more transparent disclosures. Thus empirical evidence should help demonstrate the effect of audit committees on these disclosures.

The importance of interim reports to stock market participants' investment decision-making processes is well documented in the literature. First, within market-based research, studies that directly examine the usefulness of interim reports document contemporaneous share price movements at the release of interim earnings (e.g., Rippington and Taffler, 1995; Schadewitz et al., 2002). Indeed, Landsman et al. (2002) show in a longitudinal study that share price movements to the release of interim earnings have improved since the 1960s, an indication of the increased importance attached to and usage of interim information by market participants. Second, studies of financial information user-surveys also show that interim reports are considered important for investment decision-making. For example, Bence et al. (1995) and Barker (1998) show that institutional investors and investment analysts generally perceive the interim report as an important useful source of information for decision-making. Additionally, Cornell and Landsman (1989) further document evidence indicating that analysts revise their annual earnings forecasts at the release of interim reports, suggesting usage of the interim reports to improve forecasts of annual earnings.

The importance of interim reports to market participants is further demonstrated in the growing efforts by regulators to improve the quality of information disclosed in these reports. For instance, the Accounting Standards Board (ASB, 1997) issued a statement on interim reports and the International Accounting Standards Board (IASB) issued IAS 34 (IASC, 1998). These are intended to improve the quality of interim disclosures provided to users of interim reports. Furthermore, in the US, the Securities Exchange Commission (SEC) now requires companies to engage an external auditor to review the reports before publication (Manry et al., 2003), while in the UK a review of interim reports is a strongly recommended practice (e.g., Cadbury Committee, 1992; ASB, 1997).

Our study contributes to the growing body of literature on the relationship between corporate governance and disclosure in a number of ways. First, whereas most previous disclosure studies are concerned with the relationship between corporate governance and annual disclosures, we examine the relationship between corporate governance and interim report disclosures, an aspect of financial reporting that is growing in importance. As we noted earlier, no study has examined the effect of corporate governance in the context of interim reports, and thus, our study is the first internationally to investigate this issue. Given that the role of corporate governance is to ensure that the interests of shareholders are protected through effective oversight of all aspects of financial reporting, the results of our study are important. Interim reports are an important way to improve financial reporting, reduce information asymmetry between managers and investors (Healy and Palepu, 2001; Schadewitz et al., 2002), and focus more on supplying information for investors (ASB, 1997b; Schadewitz et al., 2002).

Our second contribution is that we examine the impact of audit committee characteristics rather than merely the presence of the audit committee, which most previous studies have tended to address (e.g., Forker, 1992; Dechow et al., 1996; McMullen, 1996; Ho and Wong, 2001). Raghunandan et al. (2001) and Carcello and Neal (2003) suggest that certain audit committee characteristics may critically impact the execution of the financial reporting oversight duties of the audit committee. Indeed the Smith Committee (2003) in the UK and the BRC (1999) in the US also suggest that audit committee characteristics (independence, size and expertise) are important for its effectiveness. Although some studies have investigated the relationship between audit committee characteristics and different aspects of financial reporting (e.g., Abbott et al., 2000; Raghunandan et al., 2001; Klein, 2002; Felo et al., 2003, see also DeZoort et al., 2002 for a review), no such study has specifically addressed interim financial reporting. In the context of the UK, only Song and Windram (2004) examine the effectiveness of the audit committee by investigating a sample of companies subject to an adverse ruling by the Financial Reporting Review Panel (FRRP). We, therefore, provide the first evidence regarding the relationship between audit committee characteristics and interim disclosure.[2] Our study also provides UK evidence in relation to the recommendations of the Smith Committee (2003) that certain audit committee characteristics contribute to audit committee effectiveness in the financial reporting process.

The third contribution is that we examine the relationship between interim disclosure and shareholding of audit committee members, a variable that prior disclosure studies have not included in their models. Lavelle (2002) suggests that high shareholding by audit committee members in a company could cause them to act in their own interest at the expense of other shareholders. Referring to the Enron case, he notes that audit committee members owned a substantial number of shares and three of the members sold 100,000 shares worth more than US$7.5m before the company collapsed. These shares could have plummeted in value had the audit committee forced the company to disclose certain transactions about the operations of the company (Lavelle, 2002). This suggests that when the audit committee's share ownership is high, its independence in monitoring the financial reporting process may be compromised.

The remainder of the paper is structured as follows. Section 2 examines prior literature into corporate governance, and in Section 3, the hypotheses are developed. In Section 4, the research design is presented. Section 5 presents the empirical results and a discussion of the findings. Finally, Section 6 presents a summary of the main issues and concluding remarks.

2. Corporate governance, the audit committee and interim financial reporting

Keasey and Wright (1993) identified a number of corporate governance control mechanisms that are designed to reduce agency costs associated with the separation of ownership and decision control. These include the board of directors, institutional shareholders, auditors, and the market for corporate control. The board of directors is considered the central corporate governance control mechanism responsible for monitoring the activities of managers (Short et al., 1999). Indeed, Jensen (1993) describes the board of directors as the apex of the internal control system in an organisation, and Fama and Jensen (1983) contend that the board of directors receives its authority for internal control from the shareholders. Therefore, the board of directors exists to protect the interests of shareholders (who appointed them) where there is a separation of ownership and decision control. In this regard, the board assumes an oversight role involving a number of diverse and important responsibilities, which are executed through four main committees, including the audit committee.[3]

The role of the audit committee is to assume the key responsibility of representing corporate boards on oversight matters related to the credibility of financial reporting, auditing and overall corporate governance (Braiotta, 1999; Levitt, 2000; McDaniel et al., 2002; Song and Windram, 2004; Turley and Zaman, 2004). In this context, the Blue Ribbon Committee (BRC, 1999, p.7) regards the audit committee as 'the ultimate monitor' in the financial reporting process. Thus, the audit committee is seen as an important element in the corporate governance process, as well as being the primary decision-making body that is expected to monitor and enhance the quality of the financial reporting process in an organisation.

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[2] We believe that the UK represents the most useful context in which to examine the impact of audit committee characteristics on interim financial disclosures for two main reasons. First, the financial reporting environment in the US is more prescriptive than in the UK (Short and Keasey, 1999; Clatworthy and Jones, 2003). For example, while in the UK companies are encouraged to comply with the Combined Code on Corporate Governance, US companies are required to comply with certain corporate governance requirements (see Sarbanes-Oxley Act of 2002). Consequently, variations in the composition of audit committee (in terms of size, financial expertise and independence) are more likely in the UK than in the US. The second reason is that US companies operate in an environment characterised by shareholder litigation (Francis et al., 1994) and it is suggested that US companies sometimes fail to make complete and honest disclosures because of the threat of shareholder litigations (Baginski et al., 2002). In the UK, unlike the US, incidences of shareholder litigation are rare (Clatworthy and Jones, 2003). Therefore, audit committees in the UK have an opportunity to influence disclosures without the fear of litigation.

[3] Other board committees are the executive, remuneration and nomination committee.

Given the perceived importance of the audit committee in the financial reporting process, the Cadbury Committee (1992) recommended that all listed companies in the UK should establish an audit committee. Additionally, the Cadbury Committee (1992) and the Smith Committee (2003) recommend that the board of directors, through its audit committee, should present a balanced and understandable assessment of the company's position and prospects to ensure that shareholders and other investors are protected. This assessment needs to address the clarity and completeness of disclosures in the financial statements and should be extended to interim and other price-sensitive public reports (Smith Committee, 2003, para. 5.1). These recommendations are particularly important given that management has a greater opportunity to manipulate interim earnings because they are not audited (Mendenhall and Nichols, 1988) and/or are not as highly regulated as annual reporting (Hussey and Woolfe, 1998). Indeed as some practitioners claim (see for example, Internal Auditor, 2000), most fraudulent financial statements start with the interim reports. Thus, the review of the interim reports by the audit committee should help to alleviate this problem, as well as improving the quality of disclosures in these reports.

Empirical research provides evidence on the potential contribution of the audit committee in the financial reporting process. For example, Forker (1992) and Ho and Wong (2001) show a positive relationship between the presence of an audit committee and the extent of disclosure. McMullen (1996), Dechow et al. (1996) and Peasnell et al. (2001) find that firms committing financial reporting fraud are less likely to have audit committees. Additionally, Turley and Zaman (2003) provide survey evidence indicating that audit committees are involved in different aspects of the financial reporting process such as reviewing reports and auditor engagement. These studies suggest that the presence of an audit committee improves the quality of financial reporting. Other recent research explores the effect of audit committee characteristics on different aspects of the financial reporting process (e.g.; Abbott et al., 2000; Raghunandan et al., 2001, DeZoort and Salterio, 2001; Felo et al., 2003; Song and Windram, 2004). Taken overall, these studies document that independence and financial expertise are important attributes of an effective audit committee. However, neither of these studies has examined the effect of audit committees on other publicly available price-sensitive reports, such as interim reports.

3. Hypotheses development

3.1. Audit committee characteristics

As we described in the previous section, the audit committee has the role of ensuring the quality and credibility of financial reporting, and, previous studies show that audit committee characteristics have an influence on the effectiveness of the audit committee. We therefore develop hypotheses regarding the effect of three audit committee characteristics: shareholding of audit committee members (as a proxy for audit committee independence), audit committee financial expertise and audit committee size.

3.1.1. Shareholding of audit committee members

From an agency theory perspective, share ownership by audit committee members, as non-executive directors (NEDs), could affect their incentive to monitor the financial reporting process (Short et al., 1999). Jensen (1989) and Shivdasani (1993) suggest that non-executive directors who hold a large equity stake in the firm are more likely to have a greater incentive to monitor managers than those without such a stake. This suggests that a high shareholding by the audit committee members (as NEDS) might be expected to improve the monitoring of the financial reporting process and encourage higher levels of disclosure to the capital market.

However, while shareholding may motivate audit committee members to monitor financial reporting effectively, a contrary view argues that it may compromise their independence. Audit committee members with high shareholdings may seek greater levels of influence in the operations of the firm in order to protect their investments. This is more likely to threaten monitoring quality, violate the independence of the audit committee (Forker, 1992), and reduce members' motivation to consider shareholders' interests ahead of their own. As Carcello and Neal (2003) suggest, when audit committee members have high ownership of the company's shares, there is a likelihood that they may collude with management to protect their investments. In this setting, high share ownership could be detrimental to the audit committee's independent monitoring of the financial reporting process.

No prior studies have directly examined the relationship between corporate disclosure and shareholding of audit committee members. However, Carcello and Neal (2003) provide indirect evidence that the level of shareholding by audit committee members influences decision-making. They found that firms in which audit committee members' share ownership was high were more likely to dismiss an external auditor after issuing a going concern report. Their interpretation is that because of the vested interest in the impact of such a qualification, they were more likely to disagree with the external auditor.[4] Given that the predicted effect is unclear, we offer the following open-ended hypothesis:

H_1: There is a significant relationship between shareholding of audit committee members and disclosure in interim reports.

3.1.2. Audit committee financial expertise

The BRC (1999) and the Smith Committee (2003) also propose that the audit committee should have members who are knowledgeable of the business environment, at least one of whom must have accounting or related financial management expertise, defined as the ability to read and understand fundamental financial statements. This expertise may be demonstrated by previous or current employment in finance or accounting and/or membership of a professional financial or accounting body (Smith Committee, 2003, para. 3.16).

Bull and Sharp (1989), DeZoort et al. (2001) and McDaniel et al. (2002) emphasised the importance of financial knowledge by the audit committee. Knowledgeable audit committee members are in a better position to understand auditor judgements and discern the substance of disagreements between management and external auditors. Furthermore, it will improve audit committee effectiveness in identifying and asking questions that 'make management think harder and auditors dig deeper' (Levitt, 2000). Additionally, Knapp (1987) contends that if the audit committee does not possess the knowledge necessary to understand technical auditing and financial reporting issues, its oversight role is likely to be discounted by the auditor and management. This would undermine the effectiveness of the audit committee in the financial reporting process.

Empirical research suggests that financial expertise improves audit committee effectiveness. For example, Abbott et al. (2000) indicate a negative relationship between financial expertise and financial statements fraud, while Felo et al. (2003) reports a positive relationship with financial reporting quality. Both DeZoort and Salterio (2001) and Carcello and Neal (2003) show a negative relationship between financial expertise and auditor dismissal in cases of auditor-management disagreements. Song and Windram (2004) also reveal a negative relationship between audit committee financial expertise and adverse ruling by the FRRP. This leads us to the following hypothesis:

H_2: There is a positive significant relationship between financial expertise on the audit committee and disclosure in interim reports.

3.1.3. Audit committee size

The size of the audit committee may also influence the level of disclosure in interim reports. The Cadbury Committee (1992), the BRC (1999) and the Smith Committee (2003) recommend a minimum audit committee membership of three non-executive directors. The BRC (1999) further noted that the complexity of the accounting and financial reporting matters reviewed by the audit committee requires considerable director resources, both in terms of number of directors dedicated to the committee and the time each director devotes to committee matters. This seems to suggest that larger audit committees give rise to more effective monitoring. Bedard et al. (2004) attribute this to the fact that a larger audit committee is more likely to uncover and resolve potential problems in the financial reporting process. This is because it is likely to provide the necessary strength and diversity of expertise and views to ensure effective monitoring.

Empirical evidence on the impact of audit committee size on financial reporting is mixed. Archambeault and DeZoort (2001) find a significant negative relationship between audit committee size and suspicious auditor switches. Song and Windram (2004) also find a negative relationship between audit committee size and an adverse ruling by the FRRP. Felo et al. (2003) report a positive relationship between audit committee size and the quality of financial reporting. However, both Abbott et al. (2004) and Bedard et al. (2004) report no significant relationship between audit committee size and earnings management. Given the mixed results from previous studies, we make no directional prediction, thus:

H_3: There is a significant relationship between size of the audit committee and disclosure in interim reports.

3.2. Control variables

To test the hypotheses on the relationship between audit committee characteristics and interim financial disclosure, we control for other variables likely to influence corporate disclosure. We draw from previous disclosure studies and examine other corporate governance control mechanisms as well as company-specific variables.

3.2.1. Other corporate governance control mechanisms

The audit committee does not function in a corporate governance vacuum (Klein, 2002). The effectiveness of its oversight of the financial reporting process is embedded in the larger corporate governance process (BRC, 1999; Smith Committee, 2003). Indeed, the audit committee is responsible to the overall board of directors, which has fiduciary responsibilities to the shareholders. Therefore, in view of its interaction with the board, we also examine the impact of other corporate governance control mechanisms on interim disclosures.

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[4] For example, Jones (1996) associates modified reports with declines in stock prices.

Non-executive directors

Beasley (1996) finds that the presence of the audit committee does not affect the likelihood of fraud, although the proportion of non-executive directors has a significant negative effect. We therefore control for the monitoring effect of non-executive directors. Monitoring of management by non-executive directors suggests that the managers will become more responsive to investors (Forker, 1992; Ho and Wong, 2001). Furthermore, non-executive directors will more likely enforce the firm's compliance with the disclosure requirements, which in turn will enhance the comprehensiveness and quality of disclosure (Chen and Jaggi, 2000; Forker, 1992). Both Leftwich et al. (1981) and Fama and Jensen (1983) argue that the larger the proportion of non-executive directors on the board, the more effective it will be in monitoring managerial opportunism, and therefore companies can be expected to make more interim disclosures.

Institutional shareholding

We also control for institutional shareholding. Prior studies (e.g., Healy et al., 1999; Ajinkya et al., 2005) argue that institutional investors desire and demand greater levels of disclosure in their trading activities. We therefore expect a relationship between interim disclosure and institutional shareholding. However, empirical evidence on the relationship between institutional shareholdings and disclosure provides mixed results. For example, Schadewitz and Blevins (1998) reveal a negative relationship between institutional shareholding and interim disclosure, while Eng and Mak (2003) reported no significant relationship with voluntary annual disclosures.

External auditor involvement

Another factor that is likely to influence corporate managers to disclose more information in interim reports is auditor involvement. The role of the external auditor is to provide shareholders with an external and objective check of the financial statements (Cadbury Committee, 1992). This role includes ensuring compliance with disclosure regulations as well as engaging in best reporting practices. If external auditors encourage good reporting practices, we expect disclosure in interim reports to be greater in companies that have an auditors' review report than those that do not.[5]

3.2.2. Company-specific variables

The company-specific variables we control for drawing from previous studies are company size, multiple listing, gearing, reported interim profit, liquidity and executive directors' shareholding.

Company size

We expect company size to be related to interim disclosure for a number of reasons. Larger companies' costs of producing and disseminating information are likely to be decreasing per unit of firm size due to some fixed component (Wallace and Naser, 1995). In addition, larger companies are more likely to have a higher analyst following than smaller companies (Hussain, 2000) and therefore the demand for interim information is also likely to be greater. Furthermore, large companies are more likely to have dispersed ownership and hence higher agency costs (Cooke, 1989).

Multiple listing

We control for multiple listing since previous studies (e.g., Cooke, 1989; Gray et al., 1995; Depoers, 2000) report greater voluntary disclosures for multiple-listed companies. Some of the reasons include greater information demand by foreign investors (e.g., Cooke, 1989; Gordon and Bovenberg, 1996), the need to satisfy additional information requirements of foreign stock exchange (e.g., Gray et al., 1995; Depoers, 2000; Haniffa and Cooke, 2002) and, a more dispersed ownership, thus making monitoring costs more significant (Cooke, 1989; Depoers, 2000).

Gearing

Leftwich et al. (1981) argue that gearing may also affect disclosure because agency problems are more likely to increase with the level of debt. Day and Taylor (1996) show that UK lenders require interim reports for testing compliance with loan covenants. Greater levels of disclosure in these reports should assist lenders in this process. Hence, we expect a relationship between gearing ratio and the level of disclosure in UK interim reports. Schadewitz and Blevins (1998) and Tan and Tower (1999) report a negative association using Finnish companies, and Singaporean and Australian companies respectively.

Reported interim profit

We also expect reported interim profit to be related to interim disclosure. This is consistent with theory (Ross, 1979), which suggests that managers of profitable companies are motivated to disclose more information in order to distinguish themselves from less profitable companies, and avoid being labelled 'a lemon' (Akerlof, 1970). However, Chen et al. (2002) find that companies reporting a loss were more likely to include a balance sheet with quarterly earnings announcements, so the predicted relationship is unclear.

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[5] In the UK, the review of interim accounts by external auditors before publication is voluntary, although the Cadbury Committee (1992) recommends that external auditors should review interim reports and discuss the review with the audit committee.

Liquidity

Wallace and Naser (1995) argue that firms whose liquidity is high are likely to disclose more information to show the capital market that they have the resources to meet their short-term objectives. We expect companies with higher liquidity to disclose more interim information to show their ability to sustain their forecast earnings.

Executive directors' shareholding

Executive directors' shareholding has also been linked to differences in disclosure levels in a number of studies (e.g., Craswell and Taylor, 1992). A high shareholding may therefore result in greater disclosure, thus reducing agency costs (Leftwich et al., 1981). Executive directors may also be motivated to disclose more if they intend to engage in trading their shares. First, greater levels of disclosure would more likely increase liquidity of the company's shares and consequently the price of the shares (e.g., Healy and Palepu, 2001). Second, company directors are insiders and therefore any trading by them falls under the issue of insider dealing regulation (Hamill et al., 2002). The restrictions on insider trading would therefore provide directors with incentives to make voluntary disclosures to the capital market.

4. Research design

4.1. Sample

The sample of this study is limited to companies that are listed on the London Stock Exchange (LSE) since there are no requirements from law and/or accounting standards for the publication of interim reports by private companies in the UK.[6] A sample of 284 industrial companies listed on the LSE[7] was randomly selected from the Waterlow Stock Exchange Yearbook 2002, and a letter of request for the latest interim and annual reports was sent out to all the companies. At the first request, a complete set of 239 (84%) interim and annual reports was received. Follow-up efforts to collect the remaining reports generated a complete set of 23 additional interim and annual reports. The resultant sample therefore comprised of 262 companies and the reports received were published in the period 2001–2002. We tested for non-response biases of early versus late respondents using the student t-test and detected little indication that response bias is a serious threat to the validity of the results reported in this study.

4.2. Interim disclosure index

We define interim disclosure as the publication in interim reports of any type of information, both financial and non-financial, including notes to the accounts, management commentary and any other supplementary information. We employ the disclosure index methodology to measure the level of interim disclosure (e.g., Cooke and Wallace, 1990; Marston and Shrives, 1991). To develop a comprehensive scoring method, we conducted an extensive review of the literature (e.g., ASB, 1997a&b; Hussey and Woolfe, 1998; IAS, 1998; Schadewitz and Blevins, 1998) and constructed a disclosure list comprising 113 items of information.[8] This list includes both mandatory and voluntary disclosures. The mandatory disclosures are those stipulated in the Listing Regulations (FSA, 2000), which only require certain profit and loss items and an explanatory note, balance sheet and cash flow statement.[9] We include the mandatory disclosure items (only 16 profit and loss items) because prior studies (e.g., Hussey and Woolfe, 1998) indicate that UK companies do not always comply with the minimum disclosure requirements.

On the basis of previous studies, we develop two disclosure indexes for each company: the weighted and unweighted indexes. We develop the weighted disclosure index because it is argued that weighting reflects the perceived disclosure required by investors, who are typically the main users of financial report information in general (Zarzeski, 1996; Healy and Palepu, 2001) and interim information in particular (ASB, 1997b; Schadewitz et al., 2002). The weights for each item were based on 79 investment analysts' perceptions of the importance of the 113 items disclosed in interim financial reports (Appendix).[10] We also employ the unweighted disclosure index because some studies argue that weighting of dis-

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[6] UK listed companies are required by the Listing Regulations (FSA, 2000) to publish a half-yearly report.

[7] The term 'industrial companies' excludes financial and insurance companies (including managed funds and investment trusts). These companies are excluded because they face additional demands of information from regulatory authorities (e.g. banks are required to disclose other information by the Bank of England), which are not faced by industrial companies (Cooke, 1989). Therefore from the total listed companies, all financial and insurance companies were eliminated and this resulted in 1,201 industrial companies. The sample was then determined based on the table developed by Krejcie and Morgan (1970).

[8] This is the most comprehensive list of items ever constructed for a study examining disclosure in interim reports. To date the most comprehensive list was constructed by Schadewitz and Blevins (1998) in a Finish study, which included only 26 disclosure items.

[9] However, in terms of the balance sheet and cash flow statement, the Listing Regulations (FSA, 2000) do not provide guidance on what should be disclosed in these statements.

[10] A five-point Likert-scale questionnaire (where 1 is not at all important, and 5 is extremely important) containing all the items was sent to 313 investment analysts to determine the perceived importance of the items for investment decision-making. The investment analysts were drawn from the membership of the London Stock Exchange and Institute of Fund Managers Association as at 31 July 2002. A total of 79 (25.2%) usable questionnaires were returned and the responses were used to compute weights for each disclosure item (see Appendix).

Table 1
Measurement of independent variables

Variable	*Operationalisation*	*Acronym*
1. Audit committee characteristics		
Shareholding of audit committee members	Percentage of shares owned or controlled by directors who are members of the audit committee at the preceding annual report date.	AudCosh
Audit committee financial expertise	Dummy variable coded 1 if at least one member of the audit committee has accounting or financial management experience; 0 otherwise.	AudExpert
Size of audit committee	Number of directors on the audit committee at the preceding annual report date.	AudSize
2. Control variables		
2.1. Other corporate governance control mechanisms		
Proportion of non-executive Directors	Number of non-executive directors divided by total number of all directors on company's board of directors at the preceding annual report date.	PropNED
Institutional shareholdings	Percentage of shares held or controlled by institutions owning 3% or more of the equity at the preceding annual report date.	InShares
Auditor involvement	Dummy variable coded 1 if company's interim results were reviewed/audited; 0 otherwise.	Auditor
2.2. Company-specific variables		
Company size	Measured in terms of total assets at interim period end.	Size
Multiple listing	Dummy variable coded 1 if company is multiple listed, 0 otherwise.	Listing
Gearing ratio	Long-term debt divided by long-term loans plus shareholders' equity at the end of interim period.	Gear
Reported interim profit	Dummy variable coded 1 if net profit before interest and tax during the interim period is positive, 0 otherwise.	Profit
Liquidity ratio	Current assets divided by current liabilities at end of interim period.	Liquid
Executive directors' shareholdings	Percentage of shares owned or controlled by executive directors at the preceding annual report date.	ExDshares

closure items does not alter the results significantly as companies disclose important items as much as they disclose unimportant items (Cooke, 1989; Wallace and Naser, 1995; Ho and Wong, 2001). The approach to base the analysis on both the weighted and unweighted indexes is an attempt to provide fresh evidence using the interim report, a disclosure medium that is considered relevant mainly to investors (Schadewitz et al., 2002).

For each company in the sample, the level of interim disclosure is measured as follows. With regard to the unweighted interim disclosure, a dichotomous procedure is employed where an item is scored 1 if it is disclosed or 0 if it is not disclosed (Cooke, 1989; Haniffa and Cooke, 2002), taking into consideration item applicability to a particular company (Wallace and Naser, 1995; Haniffa and Cooke, 2002). After scoring the entire interim report, the total disclosure score is divided by the total possible score for each company to produce an index. The weighted disclosure index is computed in a similar manner, with the excep-

Table 2
Descriptive statistics of interim disclosure and continuous independent variables

Variables	*Min*	*Max*	*Mean*	*Median*	*Std Dev.*	*Skew.*	*Kurt.*	*K-S Lilliefors*	
								Statistic	*Sig.*
WtInDI	0.11	0.91	0.717	0.730	0.122	–0.471	–0.211	0.073	0.002
UwtInDI	0.11	0.92	0.692	0.716	0.127	–0.474	–316	0.065	0.011
AudCosh	0.00	0.62	0.0356	0.010	0.19	3.995	18.614	0.347	0.000
AudSize[a]	0.00	7.00	3.12	3.00	1.09	0.037	0.378	0.257	0.000
PropNed	0.18	0.83	0.4872	0.50	0.14	–0.405	0.746	0.080	0.000
InShares	0.00	0.97	0.2385	0.20	0.187	0.751	0.126	0.100	0.000
Size	1.22	20363.3	823.62	123.62	1985.19	5.214	39.404	0.339	0.000
Gear	0.00	27.98	0.95	0.58	0.25	10.244	133.13	0.317	0.000
Liquid	0.008	24.94	2.1948	1.348	3.16	4.526	23.263	0.306	0.000
ExDshares[b]	0.00	0.86	0.13	0.04	0.18	1.694	2.409	0.232	0.000

Variable definitions

WtInDI – Weighted Interim Disclosure Index
UwtInDI – Weighted Interim Disclosure Index
AudCosh – Percentage of shares owned or controlled by members of the audit committee
AudSize – Number of directors on the audit committee
PropNed – Proportion of non-executive directors
InShares – Percentage of shares held by institutional shareholders
Size – Company size, measured in terms of total assets
Gear – Gearing, measured in terms of long-term debt to the total of long-term debt and equity
Liquid – Liquidity ratio, measured in terms of currents assets to current liabilities
ExDshares – Percentage of shares owned or controlled by executive directors

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[a] Three companies had no audit committees, although they indicated that they were in the process of forming one. These were excluded from the regression analysis.

[b] There are cases where the executive directors held some shares in the companies, but because the proportion was very small (less than 0.0001, these were reported as 0.00).

tion that each disclosure item receives a mean rating (as determined from questionnaire analysis) rather than a 1 when disclosed. The item still receives a 0 when it is not disclosed.

4.3. Independent variables

Table 1 summarises the measurement of the independent variables employed in the analysis. The data for measuring the independent variables were collected from both interim and annual reports.

4.4. Models

In order to examine the relationship between the audit committee characteristics and interim disclosure, we employ the ordinary least squares regression procedures. In this respect the following two multiple regression models are specified, one with the weighted disclosure index and the other with the unweighted disclosure index:

$$\begin{aligned}\text{WtInDI} = \ & \beta_0 + \beta_1\text{AudCosh} + \beta_2\text{AudExpert} \\ & + \beta_3\text{AudSize} + \beta_4\text{PropNed} \\ & + \beta_5\text{InShares} + \beta_6\text{Auditor} \\ & + \beta_7\text{Size} + \beta_8\text{Listing} + \beta_9\text{Gear} \\ & + \beta_{10}\text{Profit} + \beta_{11}\text{Liquid} \\ & + \beta_{12}\text{ExDshares} + e_j \end{aligned} \tag{1}$$

$$\begin{aligned}\text{UWtInDI} = \ & \beta_0 + \beta_1\text{AudCosh} + \beta_2\text{AudExpert} \\ & + \beta_3\text{AudSize} + \beta_4\text{PropNed} \\ & + \beta_5\text{InShares} + \beta_6\text{Auditor} \\ & + \beta_7\text{Size} + \beta_8\text{Listing} + \beta_9\text{Gear} \\ & + \beta_{10}\text{Profit} + \beta_{11}\text{Liquid} \\ & + \beta_{12}\text{ExDshares} + e_j \end{aligned} \tag{2}$$

Where:

WtInDI = Weighted interim disclosure index
UWtInDI = Unweighted interim disclosure index
$\beta_0 \ldots\ldots \beta_{12}$ = Regression coefficients
ej = Error term

5. Empirical tests and results

5.1. Descriptive analysis

Tables 2 and 3 present the descriptive statistics of the interim disclosure indexes (dependent variables) and independent variables [continuous and categorical (dummy) variables], respectively. Table 2 shows that our dependent variables (WtInDI and UwtInDI) have no serious problems related to skewness and kurtosis. However, the Kolmogorov-Smirnov (K-S Lilliefors) normality test suggests that the assumptions of normality

Table 3
Tests for differences in interim disclosure scores for categorical independent variables

Variable	*No.*	*Mean*	*Std Dev*	*t-value*	*Sig.*
Panel A: Weighted Interim Disclosure Index					
Audit committee financial expertise					
Presence of financial expertise	141	0.744	0.091	5.344	0.0001
No presence of financial expertise	118	0.685	0.083		
Auditor involvement					
Reviewed by external auditor	126	0.753	0.075	6.707	0.0001
Not reviewed by external auditor	136	0.682	0.094		
Multiple listing					
Multiple listed	47	0.803	0.057	10.210	0.0001
Domestic listed only	215	0.678	0.087		
Interim reported profit					
Profit	198	0.727	0.092	3.148	0.002
Loss	64	0.684	0.086		
Panel B: Unweighted Interim Disclosure Index					
Audit committee financial expertise					
Presence of financial expertise	141	0.730	0.101	4.807	0.0001
No presence of financial expertise	118	0.672	0.089		
Auditor involvement					
Reviewed by external auditor	126	0.745	0.075	7.159	0.0001
Not reviewed by external auditor	136	0.664	0.105		
Multiple listing					
Multiple listed	47	0.796	0.061	10.265	0.0001
Domestic listed only	215	0.682	0.095		
Interim reported profit					
Profit	198	0.711	0.099	2.149	0.033
Loss	64	0.679	0.098		

were not met.[11] Table 2 also shows that our continuous independent variables are not normally distributed as measured by the skewness and kurtosis. This is also supported by the results of the K-S Lilliefors normality test. In addition, an analysis of residuals, plots of the studentised residuals against predicted values, as well as the Q-Q plots indicated the assumption of homoscedasticity, linearity and normality were not met (see Field, 2000). Therefore, both the dependent and continuous independent variables were transformed using normal scores (Cooke, 1998; Haniffa and Cooke, 2002).[12]

Table 2 shows that the weighted interim disclosure score ranges from 0.11 to 0.91, with a mean of 0.717 and a median of 0.730. The unweighted interim disclosure score ranges from 0.11 to 0.92, with a mean of 0.692 and median of 0.716. The correlation between the weighted and unweighted interim disclosure scores is significantly positive ($r= 0.944$, $p<0.0001$). These results are consistent with the argument that companies that are good at providing important information items are also good at providing other additional less important information items (Cooke, 1989; Wallace and Naser, 1995).

Table 3 shows the four categorical (dummy) variables included in the cross-sectional regression analysis. We used the t-test for the equality of the means of the disclosure indexes of the firms in each group. The null hypothesis that there is no significant difference between the disclosure in-

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[11] K-S Lilliefors with significance of >0.05 indicates that the distribution is approximately normal (Field, 2000).

[12] Since our dependent variables do not have serious problems related to skewness and kurtosis, we ran two regression analyses. First, we fitted the data using untransformed dependent variables, with the independent variables transformed using natural logs. Second, we transformed all the variables using the normal scores method (Cooke, 1998). Cooke (1998) propose the normal scores method as the most appropriate in transforming datasets that reveal non-linear monotonic relationships between the independent and dependent variables. In both cases, the models provided good fits to the data, although the model using normal scores transformed data provides better results. We therefore report the results of the regression analysis employing data transformed using the normal scores transformation method.

Table 4
Pearson product moment correlations among independent variables

Variable	*AudCosh*	*AudSize*	*AudExpert*	*ExDshares*	*PropNed*	*Auditor*	*Size*	*Listing*	*Gear*	*Profit*	*Liquid*	*InShares*
AudCosh	1.000											
AudSize	0.051	1.000										
AudExpert	–0.040	0.395**	1.000									
ExDshares	0.452**	–0.152*	–0.162**	1.000								
PropNed	0.006	0.391**	0.267**	–0.186**	1.000							
Auditor	–0.238**	0.113	0.088	–0.195**	0.149*	1.000						
Size	–0.084	0.467**	0.446**	–0.158*	0.292**	0.282**	1.000					
Listing	–0.030	–0.197**	0.229**	–0.069	0.139*	0.260**	0.436**	1.000				
Gear	–0.062	–0.004	–0.011	–0.047	0.049	0.071	0.075	–0.011	1.000			
Profit	0.093	0.023	0.007	0.018	0.074	0.166**	0.205**	0.011	–0.133*	1.000		
Liquid	–0.037	–0.021	–0.107	–0.003	–0.075	–0.009	–0.202**	–0.032	–0.210**	0.010	1.000	
InShares	–0.245**	0.071	0.075	–0.291**	0.085	0.093	–0.104	0.149*	–0.054	–0.037	0.017	1.000

** Correlation significant at the 0.01 level (two-tailed).
* Correlation significant at the 0.05 level (two-tailed).

Variable definitions
AudCosh – Percentage of shares owned or controlled by members of the audit committee
AudSize – Number of directors on the audit committee
AudExpert – Audit committee financial expertise
ExDshares – Percentage of shares owned or controlled by executive directors
PropNed – Proportion of non-executive directors
Auditor – Auditor involvement
Size – Company size, measured in terms of total assets
Listing – Multiple listing
Gear – Gearing, measured in terms of long-term debt to the total of long-term debt and equity
Profit – Reported interim profit
Liquid – Liquidity ratio, measured in terms of currents assets to current liabilities
InShares – Percentage of shares held by institutional shareholders

Table 5
Multiple results for the Unweighted Interim Disclosure model

$$\begin{aligned} \text{UWtInDI} = {} & \beta_0 + \beta_1\text{AudCosh} + \beta_2\text{AudExpert} + \beta_3\text{AudSize} + \beta_4\text{PropNed} + \beta_5\text{InShares} + \beta_6\text{Size} \\ & + \beta_7\text{Listing} + \beta_8\text{Gear} + \beta_9\text{Profit} + \beta_{10}\text{Liquid} + \beta_{11}\text{Auditor} + \beta_{12}\text{ExDshares} + e_j \end{aligned}$$

R^2	0.526
Adjusted R^2	0.502
Standard Error	0.071
F- value	22.374
Significance	0.000
Number[a]	259

	Unstandardised Coefficients		**Standardised Coefficients**			
Variable	*B*	*Std Error*	*Beta*	*t-value*	*Sig.*	*VIF*
Constant	0.622	0.025	24.454	0.000		
AudCosh	–0.024	0.004	–0.306	–5.362	0.000	1.667
AudExpert	0.021	0.010	0.103	1.999	0.047	1.362
AudSize	–0.008	0.005	–0.088	–1.537	0.126	1.680
PropNED	0.003	0.036	0.004	0.076	0.939	1.355
InShares	0.082	0.026	0.153	3.166	0.002	1.189
Size	0.011	0.003	0.202	3.086	0.002	2.187
Listing	0.068	0.013	0.264	5.132	0.000	1.346
Gear	–0.001	0.002	–0.016	–0.358	0.721	1.077
Profit	0.011	0.013	0.048	0.902	0.368	1.415
Liquid	0.000	0.002	0.010	0.197	0.844	1.192
Auditor	0.036	0.010	0.178	3.625	0.000	1.231
ExDshares	–0.044	0.035	–0.078	–1.268	0.206	1.951

Variable definitions
AudCosh – Percentage of shares owned or controlled by members of the audit committee
AudSize – Number of directors on the audit committee
AudExpert – Audit committee financial expertise
PropNed – Proportion of non-executive directors
InShares – Percentage of shares held by institutional shareholders
Size – Company size, measured in terms of total assets
Listing – Multiple listing
Gear – Gearing, measured as long-term debt to the total of long-term debt and equity
Profit – Reported interim profit
Liquid – Liquidity ratio, measured in terms of currents assets to current liabilities
Auditor – Auditor involvement
ExDshares – Percentage of shares owned or controlled by executive directors

[a] We exclude three companies because they did not have an audit committee in place at the time of the study.

dexes for both the weighted and unweighted disclosures of each of the four dummy variables was rejected. This implies that greater interim disclosures are associated with audit committee financial expertise, auditor involvement, multiple listing and interim profit.

Table 4 shows the Pearson product-moment correlation matrix for the independent variables. An analysis of the statistics indicates that multicollinearity among the independent variables is not a problem. An examination of the Variation Inflation Factor (VIF) (see Tables 5 and 6) confirms the results of the Pearson product-moment correlation matrix. Multicollinearity between independent variables becomes a problem when the correlation between the variables exceeds 0.80 or 0.90 and when the VIF values exceed 10 (Field, 2000).

5.2. Multiple regression results and discussion

The results of both the unweighted disclosure model (UwtInDI) and the weighted disclosure model (WtInDI) are presented in Tables 5 and 6 respectively. As the tables indicate both models have a significant amount of explanatory power of the variability in the level of disclosure in UK interim

Table 6
Multiple results for the Weighted Interim Disclosure model[a]

$$\text{WtInDI} = \beta_0 + \beta_1\text{AudCosh} + \beta_2\text{AudExpert} + \beta_3\text{AudSize} + \beta_4\text{PropNed} + \beta_5\text{InShares} + \beta_6\text{Size} + \beta_7\text{Listing} + \beta_8\text{Gear} + \beta_9\text{Profit} + \beta_{10}\text{Liquid} + \beta_{11}\text{Auditor} + \beta_{12}\text{ExDshares} + e_j$$

R^2	0.472
Adjusted R^2	0.445
Standard Error	0.068
F- value	18.003
Significance	0.000
Number	259

	Unstandardised Coefficients		**Standardised Coefficients**			
Variable	*B*	*Std Error*	*Beta*	*t-value*	*Sig.*	*VIF*
Constant	0.627	0.025	25.359	0.000		
AudCosh	–0.015	0.003	–0.185	–3.066	0.002	1.667
AudExpert	0.023	0.010	0.122	2.242	0.026	1.362
AudSize	–0.007	0.005	–0.082	–1.349	0.179	1.680
PropNED	–0.010	0.035	–0.015	–0.283	0.777	1.355
InShares	0.086	0.025	0.175	3.429	0.001	1.189
Size	0.011	0.003	0.217	3.143	0.002	2.187
Listing	0.065	0.013	0.272	5.020	0.000	1.346
Gear	0.000	0.002	–0.005	–0.107	0.915	1.077
Profit	0.019	0.012	0.086	1.539	0.125	1.415
Liquid	–0.001	0.001	–0.046	–0.897	0.370	1.192
Auditor	0.035	0.010	0.188	3.633	0.000	1.231
ExDshares	–0.031	0.034	–0.060	–0.913	0.362	1.951

Variable definitions

AudCosh – Percentage of shares owned or controlled by members of the audit committee
AudSize – Number of directors on the audit committee
AudExpert – Audit committee financial expertise
PropNed – Proportion of non-executive directors
InShares – Percentage of shares held by institutional shareholders
Size – Company size, measured in terms of total assets
Listing – Multiple listing
Gear – Gearing, measured as long-term debt to the total of long-term debt and equity
Profit – Reported interim profit
Liquid – Liquidity ratio, measured in terms of currents assets to current liabilities
Auditor – Auditor involvement
ExDshares – Percentage of shares owned or controlled by executive directors

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[a] Given that the dependent variables and also other independent variables are not normal distributed (see Table 2), we transformed all non-normal variables using the normal scores (Cooke, 1998; Haniffa and Cooke, 2002).

reports. The *F*-value in both cases (22.372 and 18.003 for UwtInDI and WtInDI respectively) is significant at the 1% level. The unweighted disclosure model has Adjusted R^2 of 50.2%, while the weighted disclosure model has Adjusted R^2 of 44.5%. The variables that are significant are largely consistent for both regression models.

For the audit committee characteristics, the level of interim disclosure has a significant negative association with shareholding of audit committee members (AudCosh) ($p< 0.000$). This suggests that the level of interim disclosure decreases with the relative amount of shares held by audit committee members. Thus listed companies are more likely to disclose less interim information when the audit committee members hold a higher shareholding in the company. The implication of this is that although prior studies (Forker, 1992; Ho and Wong, 2001) indicate that the presence of an audit committee has a positive influence on disclosure, high shareholding could be detrimental to the effectiveness of the audit committee.

The finding of this study is important because the audit committee is assumed to make board monitoring more effective by improving the quality of financial reporting. However, the results suggest that the effectiveness of the audit committee members to enforce the quality of financial reporting is likely to be impaired if the members of the audit committee have significant shareholding in the company. The negative correlation coefficient between the level of interim disclosure and the percentage of shares held by audit committee members supports this argument.

The tests for Hypothesis 2 regarding the relationship between audit committee financial expertise (AudExpert) and the level of disclosure in interim reports show a statistically significant positive relationship (p=0.047). This is consistent with other prior studies (McDaniel et al., 2002; Felo et al., 2003) that report a positive association. These results appear to suggest that audit committees which include members with accounting or financial management expertise are likely to encourage management to disclose greater levels of information in interim reports. The findings also support the recommendations of the Blue Ribbon Committee (1999) and Smith Committee (2003) that audit committees should include at least one member with relevant financial experience in order to be effective monitors of the financial reporting process.

No significant relationship (p=0.126) was found between the audit committee size (AudSize) and the level of disclosure in interim reports. These results support the argument that a larger audit committee would not be able to contribute significantly to the quality of financial reporting more than a smaller one. Although no statistically significant relationship is detected, we observe a negative directional sign of the coefficient, thus lending modest support to the hypothesis that a smaller audit committee may improve disclosure.

In terms of the control variables included in the model, the regression results provided no support for the hypothesis of a significant association between the level of interim disclosure and the proportion of non-executive directors (PropNED) (p=0.939). This is consistent with prior disclosure studies (Ho and Wong, 2001; Haniffa and Cooke, 2002). Interim disclosure is positively related to institutional shareholdings (InShares, p=0.002), a result inconsistent with Schadewitz and Blevins (1998) who reported a negative relationship. The positive relationship between institutional shareholding and interim disclosure can be interpreted in two ways. Healy et al. (1999) suggest a preference by institutional investors to invest in companies with greater disclosures, while Felo et al. (2003) argue that institutional investors have incentives to encourage greater disclosures from companies they invest in. Thus, while institutional investors may influence company disclosure policy, their investment decisions may also be influenced by disclosure policy.[13]

We also find, in line with Hussey and Woolfe (1998), that external auditor involvement (Auditor) is positively related to interim disclosures (p=0.000). This may be interpreted in two ways. On the one hand, external auditors may have incentives to encourage greater disclosure to reduce agency costs through the loss of reputation (Baiman, 1990). External auditors associated with companies that engage in low quality disclosure may be seen by the market as of lower reputation, thus would have incentives to encourage improvement in disclosure standards to reduce agency costs. On the other hand, it is possible that greater interim disclosure could influence external auditor involvement. In this context, companies with greater disclosures may engage external auditors to signal the quality of their interim disclosures to stock market participants, thus improving their market value (Healy and Palepu, 2001).

Finally, the results also show, consistent with previous studies that large companies and companies that are multiple listed have greater interim disclosures. No significant relationship is detected for gearing (Gear, p=0.721), reported interim profit (Profit, p=0.308), liquidity (Liquid, p=0.844) and executive directors' shareholdings (ExDshares, p=0.206).

5.3. Sensitivity analyses

Taken overall, our results suggest that the shareholding and financial expertise of audit committee members have a significant influence on interim disclosures. While we have controlled for other confounding factors, the results may still be influenced by additional factors not controlled for in our model. Therefore, to investigate the robustness of our results, we performed other tests to examine the influence of some these other factors.

According to Gray et al. (1995) and Hussey and Woolfe (1998), it is possible that the relationship between disclosure and selected variables is industry specific. Since we include no control in the regression models for industry, all the regressions were re-ran with industry dummy variables to investigate whether the regression results reflect industry effects. Sample companies were classified into four industries based on Gray et al.'s (1995) industry classification, and 0,1 dummy variables used to indicate each company's industry group: (1) metals, building materials and construction, (2) engineering, (3) consumer goods and services, and (4) oil, chemicals and mining. The results of the

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[13] We do not, however, examine this endogenous link between our interim disclosure and institutional shareholding measures in our study.

Table 7
Multiple results for the Unweighted Interim Disclosure model (with industry)

$$\begin{aligned} UWtInDI = {} & \beta_0 + \beta_1 AudCosh + \beta_2 AudExpert + \beta_3 AudSize + \beta_4 PropNed + \beta_5 InShares + \beta_6 Size \\ & + \beta_7 Listing + \beta_8 Gear + \beta_9 Profit + \beta_{10} Liquid + \beta_{11} Auditor + \beta_{12} ExDshares + \beta_{13} Industry + e_j \end{aligned}$$

R^2	0.528
Adjusted R^2	0.496
Standard Error	0.071
F- value	16.646
Significance	0.000
Number	259

	Unstandardised Coefficients		**Standardised Coefficients**			
Variable	*B*	*Std Error*	*Beta*	*t-value*	*Sig.*	*VIF*
Constant	0.598	0.044	13.630	0.000		
AudCosh	–0.024	0.004	–0.307	–5.207	0.000	1.751
AudExpert	0.022	0.011	0.107	2.022	0.044	1.415
AudSize	–0.009	0.005	–0.096	–1.642	0.102	1.736
PropNED	0.004	0.036	0.005	0.103	0.918	1.370
InShares	0.082	0.026	0.154	3.136	0.002	1.214
Auditor	0.035	0.010	0.174	3.508	0.001	1.245
Size	0.011	0.004	0.211	3.163	0.002	2.248
Listing	0.069	0.013	0.267	5.122	0.000	1.368
Gear	–0.001	0.002	–0.016	–0.351	0.726	1.086
Profit	0.013	0.013	0.056	1.039	0.300	1.483
Liquid	0.000	0.002	0.014	0.284	0.777	1.242
ExDshares	–0.044	0.035	–0.077	–1.237	0.217	1.969
Industry 1	0.013	0.037	0.046	0.340	0.734	9.174
Industry 2	0.025	0.036	0.114	0.688	0.492	8.926
Industry 3	0.020	0.034	0.102	0.576	0.565	5.771
Industry 4	0.019	0.038	0.058	0.487	0.627	7.065

Variable definitions

AudCosh – Percentage of shares owned or controlled by members of the audit committee
AudSize – Number of directors on the audit committee
AudExpert – Audit committee financial expertise
PropNed – Proportion of non-executive directors
InShares – Percentage of shares held by institutional shareholders
Size – Company size, measured in terms of total assets
Listing – Multiple listing
Gear – Gearing, measured as long-term debt to the total of long-term debt and equity
Profit – Reported interim profit
Liquid – Liquidity ratio, measured in terms of currents assets to current liabilities
Auditor – Auditor involvement
ExDshares – Percentage of shares owned or controlled by executive directors
Industry 1 – Metals, building materials and construction
Industry 2 – Engineering
Industry 3 – Consumer goods and services
Industry 4 – Oil, chemicals and mining

regressions including industry dummy variables are reported in Table 7.[14] As Table 7 demonstrates, the results for our audit committee characteristics and control variables still hold, suggesting that the findings reported are not significantly influenced by industry.[15]

It is possible that the relationship between interim

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[14] We only included the results for the unweighted model since the results for the weighted model also remained largely similar.

[15] We also re-run the regression analysis with six utility companies excluded from the sample, and our results were not essentially affected. We, however, find an improvement in the Adjusted R^2 from 50.2% to 51.2%, while InShares is significant only at the 10% level.

Table 8
Multiple results for the Unweighted Interim Disclosure model (with interacted variables)

$$\text{UWtInDI} = \beta_0 + \beta_1\text{InterAudCosh} + \beta_2\text{AudExpert} + \beta_3\text{AudSize} + \beta_4\text{PropNed} + \beta_5\text{InShares} + \beta_6\text{Size} + \beta_7\text{Listing} + \beta_8\text{Gear} + \beta_9\text{Profit} + \beta_{10}\text{Liquid} + \beta_{11}\text{Auditor} + \beta_{12}\text{InterExDshares} + e_j$$

R^2	0.445
Adjusted R^2	0.417
Standard Error	0.077
F- value	15.985
Significance	0.000
Number	259

	Unstandardised Coefficients		**Standardised Coefficients**			
Variable	*B*	*Std Error*	*Beta*	*t-value*	*Sig.*	*VIF*
Constant	0.564	0.024	23.584	0.000		
InterAudCosh	0.001	0.002	–0.164	–1.973	0.050	2.967
AudExpert	0.015	0.011	0.180	2.953	0.003	1.361
AudSize	–0.017	0.006	–0.075	–1.333	0.184	1.600
PropNED	0.037	0.039	0.053	0.947	0.345	1.369
InShares	0.119	0.027	0.221	4.345	0.000	1.112
Size	0.018	0.004	0.344	4.852	0.000	2.169
Listing	0.076	0.014	0.294	5.252	0.000	1.349
Gear	–0.001	0.003	–0.029	–0.574	0.566	1.090
Profit	0.011	0.014	0.047	0.835	0.405	1.386
Liquid	0.001	0.002	0.022	0.415	0.678	1.192
Auditor	0.047	0.011	0.236	4.446	0.000	1.211
InterExDshares	3.195E–06	0.000	0.005	0.054	0.957	3.155

Variable definitions

InterAudCosh – Shareholding of audit committee members interacted with total assets.
AudSize – Number of directors on the audit committee
AudExpert – Audit committee financial expertise
PropNed – Proportion of non-executive directors
InShares – Percentage of shares held by institutional shareholders
Size – Company size, measured in terms of total assets
Listing – Multiple listing
Gear – Gearing, measured as long-term debt to the total of long-term debt and equity
Profit – Reported interim profit
Liquid – Liquidity ratio, measured in terms of currents assets to current liabilities
Auditor – Auditor involvement
InterExDshares – Executive directors' shareholdings interacted with total assets

disclosure and shareholding of audit committee members and executive directors' shareholding may be influenced by company size. For example, in a large company a director could have a small percentage shareholding, yet their investment may be sizeable, and this could influence behaviour. To test for this effect on interim disclosure we interacted the variables, AudCosh and ExDshares, with the variable, Size (measured in terms of total assets). We re-ran the regressions by replacing AudCosh and ExDshares with the new variables, InterAudCosh and InterExDshares, respectively. The results remain similar, although InterAudCosh is a less significant explanatory variable than AudCosh (see Table 8).

As shown in Table 8, InterExDshares is statistically not significant. We also re-ran the regression with InterAudCosh and InterExDshares included as additional variables rather than replacing AudCosh and ExDshares. Our results are largely similar. We find that AudCosh is still significant at the 1% level, but InterAudCosh is only significant at the 10% level. The results for both ExDshares and InterExDshares are not statistically significant. Overall, the results suggest that the relationship between interim disclosure and shareholdings of audit committee members and/or executive directors is not dependent on the absolute amount of investment.

Braiotta (1999) and DeZoort et al. (2002) argue that, in general, the audit committee should be small enough for there to be true discussion and debate between members and large enough to have members with a mix of business judgement and experience. This argument suggests that the relationship between audit committee size and disclosure could be nonlinear. Therefore, we examine the effect of squaring our AudSize variable on our regression results. We include the squared variable as an additional variable, but our results remain similar.

We further examine the robustness of our results by investigating the effect of the absolute number, rather than the proportion, of non-executive directors. Bradbury (1990) and Collier and Gregory (1999) suggest that the absolute number of non-executive directors, rather than the proportion, may influence the formation of audit committees. Both the Cadbury Committee (1992) and the Higgs Report (2003) recommends a minimum number of non-executive directors of three, although companies can have more non-executive directors. It is therefore, possible that larger numbers of non-executive directors may influence greater disclosures in interim reports. To test this proposition, we reran the regressions with the absolute number, instead of the proportion, of non-executive directors. The results we reported in Tables 5 and 6 remain largely unchanged.

6. Summary and concluding remarks

The central focus of this research is to empirically examine the relationship between audit committee characteristics and the level of disclosure in interim reports. We specifically investigated the relation between disclosure in interim reports and shareholding of audit committee members, audit committee financial expertise and size. Corporate governance committees of enquiry (Cadbury Committee, 1992; Smith Committee, 2003) recommend that the board of directors, and indeed audit committee, are not only responsible for annual reporting, but should also review other aspects of financial reporting such as interim disclosures. Further, recommendations to enhance the effectiveness of audit committees in financial reporting oversight (BRC, 1999; Smith Committee, 2003) and corporate governance studies (McDaniel et al., 2002; Carcello and Neal, 2003) suggest that certain characteristics of audit committees are paramount in enhancing their oversight roles. However, no extant empirical research exists on whether these corporate governance mechanisms have any influence on the level of interim disclosure.

This study has provided insight into these issues. We find a significant negative association between shareholding of audit committee members and the level of interim disclosure. Additionally, interim disclosure is positively and significantly related to audit committee financial expertise, while no statistically significant relationship is detected between the level of interim disclosure and audit committee size. Overall, these results suggest that audit committee characteristics may have a significant influence on how the audit committee executes its oversight of the financial reporting process. However, as Turley and Zaman (2004) argue, these characteristics are not the only factors likely to deliver an improvement in financial reporting. The fact that corporate failures and financial irregularities occur in companies with audit committees complying with recommended best practice suggests other factors also play a significant role. For example, Enron's audit committee comprised members exceeding, for example, the recommended financial expertise but still financial irregularities occurred (Benson and Hartgraves, 2002). Therefore it may be important for further research to explore the processes associated with the audit committee oversight duties.

This study has a number of limitations. One limitation is that the subjectivity problem inherent in scoring financial reports of a sample of companies may not be completely eliminated. Although every effort was made to produce an objective measure of the level of interim disclosure, it is possible that measurement errors still exist. Another limitation of this study is that the weights attached to the items of disclosure were based on the perception of one user-group and therefore the total scores obtained could represent the perceptions of investment analysts regarding interim financial disclosures. As in previous studies, the study is cross-sectional in nature and this may bias the results given that disclosure changes over time. A longitudinal analysis would have been more meaningful in uncovering stable relationships and drawing stronger conclusions from the results of the study. A further limitation regards the possibility of omitted variables in the regression model. While some control variables were included in the model, a number of factors that may influence interim disclosure (e.g., analyst following) were not included. Finally, the study examined the impact of audit committee characteristics on only interim financial reporting. Results on annual disclosures may be different given the extensive regulatory requirements in annual financial reporting (by accounting standards, Listing Regulations and the Companies Acts). Given the lack of information about the impact of audit committees on financial reporting in the UK, there is certainly scope for examining the relationship with annual disclosures as well. However, some of these limitations are common in most cross-sectional studies employing the disclosure index methodology.

In spite of these limitations, this study makes some unique contributions to the growing body of literature on the relationship between corporate disclosure and corporate governance control mechanisms. First, this is the first study to offer evidence of a relationship between the level of interim disclosure and corporate governance control mechanisms. Hitherto, there was no empirical evidence to suggest that the corporate governance mechanisms have an influence on interim disclosure policy, although corporate governance recommendations (Cadbury Committee, 1992; Blue Ribbon Committee, 1999; Smith Committee, 2003) suggest they should do. Second, this is the first study to provide evidence of a relationship between disclosure and audit committee characteristics (as recommended by the Smith Committee, 2003). In addition, it documents that there is a negative association between the shareholding of audit committee members and the level of disclosure, suggesting that audit committee members should be discouraged, rather than encouraged, to increase their shareholdings. These results have potential implications for corporate governance policymakers who are responsible for prescribing the appropriate corporate structures to ensure that shareholders and potential investors are protected. For example, regulators may consider regulations such as limiting the level of shares audit committee members can hold or prohibiting audit committee members to trade their shares during their terms of office.

Appendix

Disclosure of information by UK listed companies: interim report scoring sheet (items are organised in order of analyst mean rating)

	Disclosure item	*Mean weight (analyst rating)*	*Weighted score (mean weight if disclosed, 0 if not)*	*Unweighted score (1 if disclosed, 0 if not)*
1. MANAGEMENT COMMENTARY				
1.	Discussion of changes in capital structure	4.375		
2.	Main factors influencing performance during the period	4.264		
3.	Discussion of balance sheet position	4.236		
4.	Discussion of outlook for the remainder of the year	4.153		
5.	Discussion of cash flow position	4.139		
6.	Expected impact of acquisitions of future results	4.014		
7.	Impact of acquisitions on current interim results	4.000		
8.	Financial highlight statement	3.931		
9.	Impact of the disposals on current interim results	3.931		
10.	Sales forecast for the second half or the year	3.931		
11.	Profit or loss forecast for the second half or the year	3.889		
12.	Acquisitions of subsidiaries or other major investments	3.875		
13.	Assumptions underlying the sales and profit forecasts	3.861		
14.	Order book or backlog information	3.833		
15.	Perceived trends within the business	3.806		
16.	Reasons for the acquisitions of subsidiaries	3.806		
17.	Disposals of subsidiaries or other major investments	3.597		
18.	Current research and development expenditure	3.569		
19.	Amount of goodwill on acquisition of a subsidiary	3.542		
20.	Amount realised from the disposals	3.444		
21.	Acquisitions of fixed assets	3.431		
22.	Description of current research and development projects	3.431		
23.	Brief description of business activities of company	3.375		
24.	Reasons for the disposals of subsidiaries	3.306		
25.	Particulars of transactions involving directors	3.222		
26.	Planned research and development expenditure	3.194		
27.	Changes in directors	2.875		
28.	Reasons for changes in directors	2.764		
29.	Biography of the new directors	2.583		

Appendix
Disclosure of information by UK listed companies: interim report scoring sheet (items are organised in order of analyst mean rating) *(continued)*

	Disclosure item	*Mean weight (analyst rating)*	*Weighted score (mean weight if disclosed, 0 if not)*	*Unweighted score (1 if disclosed, 0 if not)*
2. FINANCIAL STATEMENTS				
2.1. Profit and loss information				
30.	Profit or loss on ordinary activities before tax	4.708		
31.	Profit or loss for the period	4.653		
32.	Operating profit or loss for the interim period	4.639		
33.	Profit or loss on ordinary activities after tax	4.611		
34.	Amount of turnover for the interim period	4.486		
35.	Diluted earnings per share for the interim period	4.278		
36.	Basic earnings per share for the interim period	4.236		
37.	Disclosure of operating profit of acquisitions	4.194		
38.	Comparative figures for previous interim period	4.194		
39.	Tax on profit or loss on ordinary activities	4.153		
40.	Dividends paid and proposed	4.139		
41.	Disclosure of cost of sales or gross profit for the period	4.097		
42.	Comparative figures for the previous full financial year	4.083		
43.	Dividend per share for the period	4.069		
44.	Disclosure of turnover of acquisitions	4.028		
45.	Exceptional items	3.986		
46.	Disclosure of total administrative expenses for the period	3.889		
47.	Interest payable less interest receivable (net)	3.861		
48.	Disclosure of operating profit of discontinued operations	3.847		
49.	Disclosure of amount of goodwill amortised in the period	3.750		
50.	Disclosure of turnover of discontinued operations	3.681		
51.	Depreciation charge for fixed assets for the period	3.667		
52.	Disclosure of gains or losses on disposal of assets	3.597		
53.	Share of associated companies' operating profit	3.542		
54.	Share of joint venture companies' operating profit	3.514		
55.	Minority interests	3.361		
56.	Results of operations in the process of being discontinued	3.333		
57.	Statement of total recognised gains and losses	3.292		
2.2. Balance sheet information				
58.	Total assets less current liabilities	4.208		
59.	Creditors: amounts falling due within one year	4.167		
60.	Total amount of current assets	4.139		
61.	Net current assets or liabilities	4.125		
62.	Total capital and reserves	4.083		
63.	Creditors: amounts falling due after more than one year	4.014		
64.	Provision for liabilities and charges	3.944		
65.	Total amount of fixed assets	3.917		
66.	Comparative figures for previous interim period	3.806		
67.	Comparative figures for the previous full financial year	3.806		
68.	Analysis of total current assets into component parts	3.764		
69.	Analysis of capital and reserves into component parts	3.653		
70.	Reconciliation of movements in shareholders' funds	3.528		
71.	Analysis of total fixed assets into component parts	3.292		
72.	Minority interests in equity	3.194		
73.	Disclosure of loans to joint venture companies	3.014		
74.	Disclosure of joint venture share of liabilities	2.958		
75.	Disclosure of joint venture share of gross assets	2.778		
76.	Disclosure of joint venture share of goodwill	2.736		

Appendix
Disclosure of information by UK listed companies: interim report scoring sheet (items are organised in order of analyst mean rating) *(continued)*

	Disclosure item	*Mean weight (analyst rating)*	*Weighted score (mean weight if disclosed, 0 if not)*	*Unweighted score (1 if disclosed, 0 if not)*
2.3.	**Cash flow statement information**			
77.	Net cash inflow/outflow from operating activities	4.569		
78.	Total figure for return on investments and servicing finance	4.236		
79.	Increase/decrease in cash figure	4.208		
80.	Total capital expenditure and financial investment figure	4.125		
81.	Reconciliation of movements in cash to movement in net debt	4.111		
82.	Reconciliation of operating profit to operating cash flow	4.042		
83.	Total amount of financing sources	3.944		
84.	Total amount of acquisitions and disposals	3.903		
85.	Analysis of net debt/funds	3.889		
86.	Cash flow figures for comparative interim period	3.875		
87.	Cash flow comparative figures for the previous full financial year	3.847		
88.	Equity dividends paid	3.722		
89.	Analysis of financing sources figure into different types	3.722		
90.	Breakdown of returns on investment and servicing finance into the different categories	3.694		
91.	Management of free liquid resources	3.625		
92.	Breakdown of capital expenditure and financial investment into different components	3.444		
93.	Taxation paid	3.431		
94.	Breakdown of acquisitions and disposal figure into the relevant components	3.306		
3.	**ACCOUNTING POLICIES AND OTHER INFORMATION**			
3.1.	**Segmental information**			
95.	Analysis of profit or loss by business segment	4.014		
96.	Analysis of turnover by business segment	3.917		
97.	Analysis of profit or loss by geographic location	3.542		
98.	Analysis of turnover by geographic location	3.472		
99.	Analysis of net assets by business segment	3.181		
100.	Analysis of net assets by geographic location	2.958		
3.2.	**Accounting policies and notes**			
101.	Effects of changes in accounting policy on current results	4.278		
102.	Description of the nature of any changes in accounting policy	4.181		
103.	Statement to the effect that accounting policies are consistent with those in the annual accounts	3.819		
104.	Statement of number of shares outstanding in the interim period	3.556		
105.	Date on which it is approved by the board of directors	3.528		
106.	Extent to which the information has been audited or reviewed	3.444		
107.	Basis of the tax computation	3.403		
108.	Extent of compliance with ASB statement on interim reports	3.375		
109.	Other notes to the financial statements	3.236		
110.	Methods used in computing the basic earnings per share	3.014		
111.	Methods used in computing the diluted earnings per share	2.708		
112.	Auditor review report included with the interim accounts	2.514		
113.	Company financial calendar	2.347		
	TOTAL SCORE			

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Book Reviews

Globalisation Management Control and Ideology. *Riad Ajami, C. Edward Arrington, Falconer Mitchell* and *Hanne Norreklit* (eds.). n DJOF Publishing, Copenhagen, 2005. 311 pp. Price £34

As the title of the book suggests, this collection of essays seeks to address the extent to which globalisation impacts upon the approaches to management control that are extant in different locales each with their own contexts and histories.

The structure of the book seeks to develop these themes in a series of rather different settings. The first two sections provide the bulk of the edition. The first section of the book concentrates its focus upon the effect of the tensions between the national context and a globalised world. Six different nations are studied. The national context in each case is conceptualised as a set of local ideologies driven by the religious historical context of that nation.

The second section of the book comprises five chapters and develops the overall theme of the collection by considering the role of ideologies in a variety of institutional and sectoral contexts. The introduction of the book argues that this section considers 'the relation between particular aspects of modernity and management control'. (p.17) The majority of these chapters provide case studies of the nature of control systems in different settings, two looking at the professions in different jurisdictions and another considering the expansion of New Public Management. De Geuser and Fiol (ch.9) consider the technologies of control themselves. They take an explicit look at the contradictions between the complexity of organisational settings and the simplicity of some of the technical tools we use to address this. Although Annick Bourguignon's chapter provides a framework for analysis, this is not utilised by the other authors; she does, however, point to other literatures that have started to address the ideological function of approaches to control.

In the third section (comprising two chapters) the writers seek to consciously address the role of discourse and its effect on the conceptualisation of organisations through the lens of postmodernity. The effect of these conceptualisations on modes of control is highlighted. The introduction notes rather more grandly that this section develops a concern 'with trajectories which shift the rationality of control from a modern regard with hierarchy and administration to a postmodern regard for invention, re-invention and the therapeutic.' (p.18). In looking at the role of language in the construction of the workplace, the first of these chapters returns to notions of spirituality considering New Age ideologies and how these might be used to construct the workplace. The second of these chapters considers the use of a coaching metaphor as a mode of discourse. It analyses the ideological assumptions in a web-based e-learning tool – *The Managers Junior Woodchucks Guidebook* – (a guide that clearly must be embedded with cultural assumptions and knowledge that passes me by!). The final essay in the collection considers the validity of ideological globalisation arguing that the notion of globalisation as the victory of one ideology – 'the modern capitalist control ideology' (p.306) is not valid and we should instead seek to achieve a global dialogue of ideologies. Globalisation must be seen as achieving a focus for developing and understanding diversity not achieving standardisation.

All these essays are embedded in the context of a number of priors. First, the book seems to align particular ideas of modernity with those of globalisation and management control as they are currently conceptualised, and in doing so it seeks to loosen the bindings that the latter two of these terms might be perceived to imply. As such the essays in the book seek to embrace diversity and promote the notion of the local, rejecting the rationalisation and standardisation that the leviathan of modernity might impose. It follows, therefore, that the definition of ideology that is adopted is that which sees ideology as affirmative and constitutive of social life. Ideology in this respect is the bearer of diversity that protects localism and defends against a retreat to economic subordination or the development of an alienation resulting in fundamentalist violence. While ideology is carefully defined, less attention is paid to what is understood by globalisation or management control and as such these latter two ideas are left to be implicitly understood in the context of the different essays. Because of this the assumptions made as to what is globalisation or management control are not quite so coherent, and the context of modernity in which they are placed is one that could be contested.

In many ways the aim of this collection is a brave one and carries with it, perhaps inevitably, a range of contradictions as different authors put their imprimatur upon these ideas in the different contexts. In some aspects there is a contradiction in this collection of essays between the complexity of the ideas they seek to explore and the need to simplify them to make a case. The arguments in the first section, about how religious belief systems have impacted on national cultures are a novel contribution to the area of management control. They simplify the complexity of how individual actions aggregate into societal practices, yet provide sufficient general understandings to remain relatively convincing given the level of analysis that is possible when one approaches the need to understand what might be seen as national culture. Arrington's chapter (ch.2) describing the symbolic import of ideology in the US and the extent to which the 'American Way' as a symbol becomes unquestionable is a particularly sophisticated, if chilling, example of this approach. Thus, drawing on the puritan religious underpinning of their nation Arrington argues that 'the "American Way" has never swerved at all from its principled elision of capitalism with destiny.' (p.26). In this context private and public life are not in conflict and control is individualised, linked to individual failure. Arrington argues that personal anxiety is thus the root of US control systems.

Other chapters deal with other nations, yet seek to achieve the same sort of explanations for the general approaches to control within their nations. The problem with this sort of tactic is that it imposes at the national level that which the book seems to eschew more generally; it imposes a totalising nationalisation as opposed to a totalising globalisation. This raises interesting questions that are not developed as to where localism might be seen to reside, at what level of resolution does it rest?

Perhaps the answer to this is given in other parts of the volume where great emphasis is given to notions of discourse and the impact of discourse in developing ideologies. Again one of the problems of this approach as it is adopted is that the discourses themselves become frozen in the context of ideologies. Hence there is a tension between the desire to understand ideologies as dynamic and enacted and the recourse to describing them as more static and embedded in control systems. Bourguignon (ch.8) provides a framework that encapsulates some of these tensions and calls for empirical work to explore the tensions further. This chapter perhaps provides a more nuanced approach than other chapters because the ideas in the former are not embedded in empirical 'reality'.

The final polemical chapter brings all these themes together and provides an argument against the global capitalist control ideology arguing instead for a global dialogue of ideologies. The question remains as to whether the book itself has managed to achieve such a dialogue. While the ideas are somewhat simplified in places, nevertheless the questions that are raised remain interesting and allow the reader to question both the ideas in the book and at the same time reflect upon their own preconceptions. This is a valuable thing in itself.

Overall, this book takes the idea of management control beyond the usual organisational boundaries in which it is often placed. It provides novel discussion in the context of management control, introducing the religious background of national cultures – a matter of some contemporary importance – as an element in the development of approaches to control. The focus upon the role of discourse and ideology in the context of control is also somewhat under-represented in the literature and the debates here are again interesting. The book will provide useful contextual background for researchers in management control who, depending on their own interests, will orient to different chapters in different ways.

The book provides few answers as to how to achieve the end state it prescribes. It will also disappoint those seeking a management control recipe book. Yet for the interested reader it will provoke as well as illuminate, and from that perspective it is a useful and welcome collection.

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University of London

Capital Investment Decision-Making: Some Results from Studying Entrepreneurial Businesses. *Mohsen Derregia* and *Francis Chittenden*, Institute of Chartered Accountants in England & Wales, 2004, xii + 67 pp. £20

The aim of this research study is to examine the investment decision-making processes of successful, established and entrepreneurial UK firms, with specific focus on investment and risk appraisal within that process. It specifically examines the relevance of real options to company practice and attempts to identify best practice using highly profitable and growing companies. It claims to address a number of issues not addressed by previous research (p.57), although the precise issues are not specified. This is one of the largest and most comprehensive UK studies of capital investment processes and practices, and as such is welcome and warrants serious attention.

The study analyses and reports information gathered from interviews, a postal survey and case studies. Fifty interviews were conducted on directors responsible for investment analysis. Sample firms were analysed in terms of high/average performance and listed/private status. The interview focus was on investment and risk appraisal, including the identification of real options in investment decisions and the factors that add value to the option to delay. Interviews also shed light on the possible use of payback and hurdle rates to handle uncertainty.

Based on the results of the interviews, a postal survey was employed to examine the characteristics of businesses that own capital budgets, the techniques employed and how uncertainty is handled. A healthy response rate yielded 240 responses from large and SME firms. Finally, case studies were conducted in 12 firms, seven of which are summarised, focusing on the entire investment process and whether significant differences exist between 'entrepreneurial' and 'average' firms.

The title suggests that this is a study of entrepreneurial businesses. However, it seems that the study uses 'high performer' as a proxy for entrepreneurial firm (p.7). It would perhaps be more accurate to view the study as covering SMEs and listed firms with particular focus on high-performing companies.

In a well-researched area such as capital budgeting we perhaps do not expect to find much by way of new or challenging findings. This study's findings offer more by way of confirmation than revelation, although it is appropriate that there is a stronger focus on real options than in most prior studies. It argues that 'Although there is no mechanical solution to the investment decisions-making problem, it is helpful for companies to think through the issues using a theoretically and practically informed set of key features of successful processes'(v). The numerous findings are summarised into two main findings discussed below.

Capital budgeting is not a relevant activity for all businesses. (It is an easy mistake for academics to assume that for all firms capital investment forms a large element of the capital employed and capital budgeting forms a major part of management activity.) The report finds that rather than make capital commitments, many firms, particularly SMEs, develop solutions to enhance flexibility and reduce the impact of uncertainty through operational leases, hiring, renting and outsourcing. Given the set-up costs and irreversibility of most capital projects, the key to determining whether a firm invests in capital assets is confidence in the firm's market position. Entrepreneurial firms are characterised by a more aggressive pursuit of opportunities and determination to achieve investment success.

Second, the report finds that many firms do not conduct full financial evaluations, preferring to investigate options and evaluate in more strategic terms. Simple practical techniques are used as proxies for investment and option values. While few firms formally engage in financial analysis of real options, their concept is generally understood. High-performing firms typically consider them along with some form of subjective assessment of their financial and strategic values. Successful firms tend not to reject projects because they cannot be easily quantified, relying more on qualitative and intuitive assessments and their capability for early detection and solving of problems affecting investment success.

The report offers much to commend it as important reading for researchers and practitioners alike. The criticisms discussed below are relatively minor but nonetheless real. It suffers from the authors attempt to cover findings from the three forms of data collection in so few pages. This, of course, may have been an editorial requirement, but the result is that it is often difficult to follow the flow of argument because the material is not discussed in sufficient depth. One example of this is that insufficient space is given to explaining the nature and theory of real options. Given that the report recognises that practitioners are not generally familiar with the topic, it would be helpful to have presented a clearer introduction to the subject. It does, however, provide a succinct list of the main forms of real option (expand, reduce, mothball, postpone, abandon), and remind the reader that they deal with the value of managerial intervention and timing discretion – something largely missing from conventional DCF analysis. The report also observes that total risk – rather than the market risk more commonly espoused in the capital budgeting literature – is relevant when real options are considered.

It might be hoped that given the depth and breadth of coverage the report would offer rich insights not hitherto found in capital budgeting studies. However, the interviews offered and seven reported case studies offer little discussion by executives as to how they identify, evaluate and manage investments and option-like characteristics. The cases are formal descriptions of investment processes within organisations with little commentary or analysis. If this is a true indication of the depth of the case studies it might be better to have devoted more space to discussing the other two sources of data and placed a few cases descriptions in an appendix. A helpful appendix outlines an options-based investment decision-making process, although this is not discussed in the report and it is unclear whether this is an outcome of the study.

In conclusion, the study is an important contribution to the literature but further analysis is called for to probe more deeply into some of the issues raised.

Richard Pike University of Bradford

18th Annual Conference on

Accounting, Business & Financial History

at Cardiff Business School 14-15 September 2006

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General

Papers should be in English and consist of original unpublished work not currently being considered for publication elsewhere. They should be typed and double-spaced. Four copies should be submitted, together with a submission fee of £18 for subscribers or £36 for non-subscribers. The submission fee should be paid by cheque or draft made payable to *Lancaster University*. Payment cannot be made by credit card. In order to ensure an anonymous review, authors should not identify themselves, directly or indirectly. Experience has shown that papers that have already benefited from critical comment from colleagues at seminars or at conferences have a much better chance of acceptance. Where the research takes the form of field surveys or experiments, four copies of the instrument should be submitted. Where the paper shares data with another paper, a copy of the other paper must also be provided. In the case of papers accepted for publication, authors will be asked to provide a Word file of the manuscript on CD or floppy disk, along with a hard copy version. Authors of accepted papers will also be asked to transfer copyright to the publishers.

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Tippett, M. and Whittington, G. (1995). 'An empirical evaluation of an induced theory of financial ratios'. *Accounting and Business Research*, 25: 208–218.

Watts, R. L. and Zimmerman, J. L. (1986). *Positive Accounting Theory*. Englewood Cliffs, NJ: Prentice-Hall.

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